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Muckraking.

THIS IS THE heading of an extract from the "Rock Island Employees' Magazine," published elsewhere in this issue. This is an excellent illustration of the tactics employed by and the accuracy of statements contained in sensational articles on economic subjects published in certain magazines. We hold with, we believe, every honest paper, that nothing is more salutary in its effects than full publicity, but the wilful circulation of a misstatement or a half truth, as we have said before, is the most harmful and dangerous phase of modern journalism.

Such devices serve merely to excite popular opinion for a time to the great detriment of industry and in the end are bound to bring discredit upon the authors. In due time the people will become properly informed on the subject of railway management and other phases of modern economic conditions in spite of yellow journalism and sensationalism and then, woe to the misstated.

In many cases writers of such articles are doubtless sincere in their beliefs, even as Mr. Brandeis. In such cases

the evil results are multiplied, for a man's sincerity breeds confidence and belief.

Safety.

THE THIRD annual report of the Block Signal and Train Control Board is a document well worth reading. The part which appeals to us most is the general summary at the end containing the board's recommendations and views on the subject of discipline. The position taken by the board that machines can never wholly displace men and that untrained or improperly trained men, even though surrounded by all the safeguards known to the arts, are a menace to life and limb, is one in which all rightminded persons will concur.

Rates.

MANY PAPERS are featuring the fact that in spite of the pleas of poverty raised before the Interstate Commerce Commission in the recent rate hearings, it is reported that the Harriman lines are to spend \$75,000,000 during the next five years on double-tracking. In the first place we do not recall hearing of any poverty pleas by the roads in question. In the second place, though a road or other business may be able to raise money for needed improvements, it does not follow that profits are fair or satisfactory, or that all other corporations or firms engaged in the same business in the same territory are also able to raise money. In the third place, even though one road may be earning a reasonable profit, other competing roads may not be doing so for any number of reasons, and it may be for the public good that they keep out of bankruptcy. In the fourth place, if a rate increase is necessary to a weak road, a competing strong road must also increase its rates or the increase will be of no benefit to the former, as it will get no business. In the fifth place, if one road is well managed and earning fair profits, it does not follow that a weak competing road is necessarily wasteful. Nevertheless, as one of the signs of renewed confidence and impending prosperity, the news of this bit of construction is not without significance.

The Signal Department.

THE LEHIGH VALLEY signal standards published this month are chiefly interesting as illustrating the development of the normal danger circuit. The Lehigh Valley, together with one or two other roads, has consistently used the normal danger principle from the beginning in automatic block signaling. This road, too, was one of the first and at one time was conspicuously the only road to be reasonably well equipped with automatics. Many of the pioneers in the art of signaling have served on this road and from its signal department have come two notable leaders in signaling—H. S. Balliet, past president, and C. C. Rosenberg, present secretary-treasurer of the Railway Signal Association.

Railway Management at Stations.

By E. B. Ivatts; 605 pages, cloth, 5x8½; published by McCorquodale Co., London, Eng. (New York, D. Van Nostrand Co.) 5th edition. Price \$2.50.

As this book has now been in circulation for over 20 years it needs no comprehensive review. It has met with favor in foreign countries as well as in England, although the problems demonstrated are more applicable to railway operation in Great Britain. The book is a comprehensive treatise on the duties of a station agent from the organization and training of his staff to the proper disposal of the smallest details of his work. A glossary of railway terms is included at the back of the book with an excellent cross index to the contents.

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MINE RESCUE STATIONS IN ILLINOIS.*

BY W. Y. WILLIAMS.

(Continued)

In a number of stations already built in this country, it has been the practice to divide this room longitudinally and to construct an overcast on one side, the aim being to present a passageway about the room, the travel over which would represent the journey of a rescue party through the entries of a mine. This room should be furnished with mine props and a frame consisting of four pieces of 6 by 8 timbers joined together in the shape of a square and tied with two iron rods, in which props may be set and capped with wedges; also brattice cloth, stretchers, and a canvas dummy filled with sand and sawdust so as to weigh about 165 lbs. In order that men may gain confidence in working in the presence of gas, sulphur candles may be burned in this room to form a choke-damp; charcoal may be fired in open salamanders yielding blackdamp; hydrogen disulphide may be generated producing stink-damp, or ordinary dense smoke may be obtained by burning dampened excelsior.

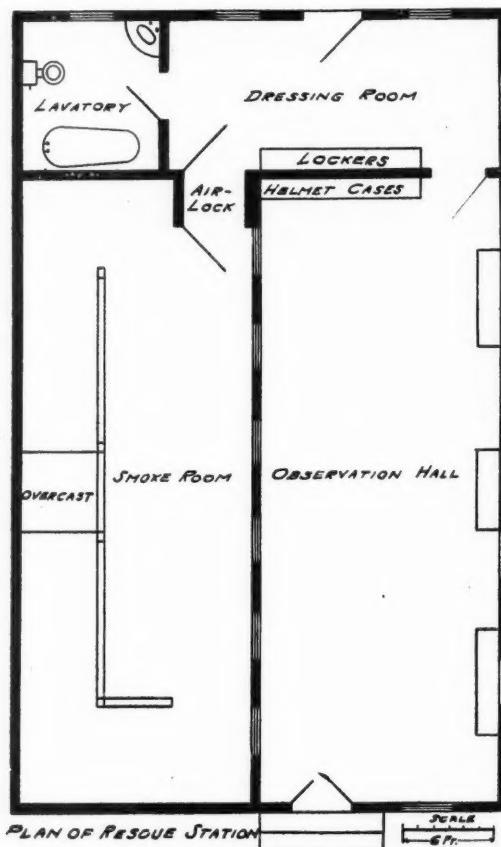
It is not sufficient training in the use of the safety appliances, and protection to the miners, to have some of the miners put on helmets and walk about or climb up into the tipple. There have been instances where men who have had such preliminary practice, when called upon to work in the mine in the presence of gas, have lost their confidence because of their knowledge that it was a dangerous situation. When this happens, the mental conditions of the men is such that they require more oxygen than the machine will give, with the result that they may collapse and have to be carried out. It is to give this experience and confidence in the apparatus that the smoke room is provided.

The experience of Mr. Roberts in the state of Washington with some of the mine operators shows this condition. Some of them took the position that it was not necessary to send the men to the station for training, as they could get it at the mine. Notwithstanding this, one of the operators was called upon to furnish a squad of men to be drilled in the use of the helmets, etc., in the smoke room. The first trial was but a short one, as the men were nervous and they could not stand the strain; they came out of the smoke room perspiring profusely. But that same squad, some three days later, did a good deal of hard work—building brick walls, carrying around the dummy, and such other work as might be necessary in case of an accident in a mine—and came out after two hours' work far less fatigued than the first time. This shows that the men's mental attitude toward rescue-work and wearing the protective devices in the presence of smoke and gas has to be trained. Such experiences show that the little rescue stations, which do not look so very much like a mine, are very valuable.

Adjoining the smoke room and separated from it by a glass partition should be an observation room, where visitors may sit and view the work of the miners. Here, too, the instructor may observe and record the performance of each member of the rescue squad. In this room there should be wall cases in which the rescue apparatus may be hung and protected from dust; there should be work benches to facilitate the cleaning of instruments and the charging of electric safety lamps; and a place to store the cases in which the apparatus is shipped.

Back of the smoke room there should be a lavatory containing toilet, shower-baths and locks for the accommodation of the miners coming to the station for practice. The equipment of the station should include oxygen helmets, or other suitable breathing appliance furnishing a dependable supply of pure air, with the aid of which men may safely enter any kind of the foulest and most poisonous

atmosphere in order to perform rescue work. Apparatus and supplies for recharging these machines. Portable electric safety lamps with a convenient device for recharging. A supply of some standard make of oil-burning safety lamps. One or more resuscitating cases for use in reviving men overcome by the afterdamps of mine fires or explosions, special cases or trunks, of convenient size for handling, in which this apparatus may be quickly packed and safely transported to the scene of an accident.



II. The character of the training given should include a general study of the conditions that obtain during and after a mine fire or explosion, with special detailed reference to concrete cases. With these actual occurrences in mind, plans should be discussed for successfully solving these problems according to modern rescue practice. The principles on which the machines used at the station are constructed and operate should be explained; and a thorough first-hand knowledge of the manipulation of the various apparatus should be acquired by the practicing miner. The training of the mind and body to do work similar to that required in the actual recovery of a mine in the presence of deadly gases should be given by drills in the smoke room. In this way, men become acquainted with the possibilities and limitations of the machines, gain knowledge as to their own prowess as rescuers, and learn to work in squads, under the leadership of one of their comrades. For mental and physical ability shown in the work, a certificate of competency should be awarded. This would tend both to keep up interest in the work of the station, and to be of especial value as a reference card when a disaster occurs.

III. The advantages that would obtain from such stations are in a large measure obvious. It often happens in an explosion that the ventilation machinery is thrown out

*Read before the Western Society of Engineers.

of commission or totally destroyed. Also it is often necessary after a gas explosion to stop the fan to prevent a series of subsequent blasts and to control a mine fire by cutting off all ventilation. Previous rescue methods have afforded only a choice between two evils; either close the mine with concrete stoppings and leave it sealed indefinitely, or start the fan, send in the men and trust to luck, with the result of the loss of many lives and much property.

With the introduction of modern practice, however, rescue work assumes a decidedly different aspect. With the aid of the breathing appliances, trained men may enter the mine at once with comparative safety and begin the task of recovery, without aid of air supply from the fan. As the work progresses, each step may be taken with a complete knowledge of the situation gained from the careful reconnaissance of the helmet men.

Not least among the advantages that would accrue from the employment of rescue stations, is that in cases of emergency there would be available squads of men trained for the undertaking, accustomed to working together and obedient to the commands of their leader.

A further advantage is that such rescue stations may become centers for the dissemination of knowledge among the men. In addition to the usual studies and lectures, local institutes could hold their meetings in the observation hall of the station; and talks and demonstrations on first aid work could be given by the town or company physician with a view to forming first aid corps similar to those that are meeting with such success in the anthracite fields of Pennsylvania.

IV. It is clearly out of the question, in view of the destructive competition that at present exists in the coal trade of this locality, to legislate against the very life of the industry by requiring each operator to establish a rescue station or to make other improvements not immediately necessary. And yet, considering all that has been and is being done by foreign and domestic stations, and remembering the advantages that would accrue from the establishment of these stations along the lines of discipline, education, etc., we are compelled to recognize their value.

The legislature of Illinois appropriated annually \$193,000.00 for investigation in agriculture. The mining and metallurgical industry of this state represents an output valued at approximately \$150,000,000.00, and for the aid of these industries the states appropriates only about \$25,000.00. In establishing and maintaining charities and schools, the state annually spends enormous sums; and while rescue stations are primarily devoted to training tending to life saving, they are or may be considered as educational centers. Moreover, the state has appropriated \$2,500.00 for the relief of the sufferers of the Cherry disaster, and the legislature is now considering bills calling for an additional benefit appropriation of \$50,000.00 to \$150,000.00. In view of these facts, it seems reasonable to ask the legislature for a grant of funds sufficient to carry on work which has for its object the saving of life and property, the training of its citizens to be effective agents of a vast enterprise and the reduction of a constantly increasing number of deaths, a special appropriation of \$30,000.00, and in addition an annual appropriation of \$30,000.00, to be expended according to the following plan of operation:

The coal field of Illinois would be arranged into three divisions, and in a centrally located city or town in each of these districts a central rescue station would be established. For example, LaSalle, Springfield and Carbondale. Each of these three cities is a railroad center, enjoying exceptional railroad facilities. A station could be built for \$5,000.00 and equipped with a complete line of apparatus for a like sum, itemized as follows:

- 12 oxygen helmets, or other suitable breathing appliances.
- 12 portable electric safety lamps.
- 12 oil-burning safety lamps.
- 6 oxygen tanks or reservoirs.
- 1 oxygen pump.
- 2 oxygen reviving outfits.
- 200 potash cartridges.

- 1 chemical cabinet for gas analysis.
 - 15 cases or trunks for transporting the above apparatus.
- Furniture, including chairs, tables, wall cases, etc., tools, supplies, etc.

In that list I wish to call attention to one thing, and that is the chemical cabinet for gas analysis. This is about the size of a dress-suit case, on end, but a little lighter. It is portable and can be taken right into the mine and a sample of the mine air can be put through the apparatus and give information as to the character of the gas to be encountered. On one occasion almost a panic was created at a disastrous mine fire by the statement that "White damp is being generated in enormous quantities." But some of the miners, having prepared themselves, had taken samples of gas and put them through the machine and demonstrated that the alarm at the presence of CO was groundless. The apparatus is inexpensive and can be used to advantage, especially in the southern fields, where large gas pockets are encountered. Thus, the three stations could be completely installed for the special appropriation of \$30,000.00.

In charge of each of these three central rescue stations there should be appointed a man whose experience in coal mining has been large and varied—some one who can maintain the interest of the miners who visit the station, care for the apparatus, and keep the records. Over the entire rescue work, with power to purchase supplies, direct the course of training and assume the entire charge in case of a mine disaster, there should be a man who is a mining engineer by profession, one who has had experience in all phases of coal mining, including mine rescue work, and one upon whom may be thrown with confidence the welfare of the whole proposition. It is proposed that such officer cooperate with the inspector in whose district a disaster may occur. It is also suggested that he report to a board of five persons, to be appointed by the governor, to consist of one inspector, one operator, one miner, the head of the department of mining engineering at the University of Illinois, and one member of the Federal Inspection Force.

Each operator of the state should be asked to send a small number, say 4 per cent, of his employees to the nearest of the central rescue stations at least twice a year for training in rescue work. These men should spend at least three days at the station on each visit. In return for this action of the operator in bearing such expense for the safety of the lives of his miners, the men so trained should agree, in cases of emergency, to assist in the work of mine rescue, with the understanding that they are to receive only the "inside wage scale" for time devoted.

I was in a mine one time where some bodies were to be removed. The superintendent of the company felt that the men who had been used to working in that mine ought to be given the opportunity of removing those bodies. The men immediately held a meeting and decided that they would do it providing the superintendent would guarantee \$1.25 an hour, which is quite a little above the inside wage scale. The superintendent then became indignant and said that he would rather get store clerks at \$10.00 an hour than give those fellows anything if that was the way they felt about helping to relieve the situation. The time to arrange the details, or as many as possible of the details, is before the calamity occurs, and I really think if the operator goes to the expense of training his men and giving them the op-

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portunity of coming to these stations and becoming proficient, that when anything occurs they should be willing to work for the inside wage scale. Then, if the operator feels like it, he can add to that at any time. But there ought not to be any haggling about price at the time there is something to be done.

These three central stations could be made of great value to both miners and operators. But one further step is necessary to complete the plan and insure its entire success, because, even with the three stations thus located, there would be an appreciable lapse of time before the apparatus could be delivered to a mine in case of trouble. So to overcome this delay, the suggestion is made that all operators combine in what may be called local or private stations, consisting merely of five helmets and five electric safety lamps, charged and packed in cases, ready for transportation, in some town or a mine where there is always someone present who can deliver the helmets as needed. This local station might be in a fire department house of the town. These local stations would serve all mines within a radius of fifteen miles. As the station equipment would consist of the five helmets and lamps, without any of the costly apparatus for recharging them, the expense, when divided among all mines within the 15-mile-radius circle, would be very small. It would be the duty of the central rescue station people to inspect and charge these helmets periodically and see to it that they are in working condition for an emergency. This might be accomplished by having the local helmets brought to the central station by the miners when they visit it for training. The object of the local stations is that the men at the mine may, in case of fire or explosion, have means at hand for preliminary work, or immediate rescue that may be necessary during the period while the men and equipment of the nearest central rescue station are journeying to the mine.

**THE PRESERVATION OF STRUCTUAL TIMBERS.
FROM DECAY.**
BY C. P. WINSLOW.
Discussion.
(Continued)

G. B. Shipley (engineer, mining and timber treating machinery department, Allis-Chalmers Co., Milwaukee, Wis.): Mr. Winslow's paper has covered the general experience of the United States as it is today. The most important point about creosoting, or timber treating, is to know how much you are going to save. Railroad engineers, in investigating this subject, will first of all strike an average of the length of time an untreated tie will last as compared with a treated tie. I think it safe to assume about five years for an untreated tie and fifteen years for a treated tie in the United States. If you agree that as the result of treating, the ties will last fifteen years, the saving in rough figures will be about \$100.00 per mile per year. Some will run above that, some below, but that is a pretty safe figure to use.

In looking through the government records of timbers used in coal mines and making a rough comparison, I find that if we would treat the principal timbers used in mines, we could save about \$12,000.00 per year in the United States alone; and that is treating only the permanent timbers, such as shaft timbers, ties underground and main run-way timbers. It of course would not pay to treat mine props or any timber subject to being covered up or lost in caving. I find that in some of the mines of this district the ties underground will last only two or three years. There is one mining company in the United States that is treating mine timbers thoroughly and that is the Philadelphia & Reading Coal & Iron Co. at Pottsville, Pa. As Mr. Winslow says, they have found that it pays to give their main

mine timbers a slight treatment of either zinc chloride or creosote at a cost of about \$6.00 a thousand and they can save from 2½ cents to 3½ cents per cubic foot of timber going into the mine.

The question of treatment is one that has been carefully considered all over the United States and it has been resolved into the following important processes, using two antiseptics, creosote oil and zinc chloride:

1. Burnettizing process.
2. Wellhouse process.
3. Absorption process.
4. Full cell creosote process.
5. Rueping process.
6. Lowry process.
7. Card process.

These processes, with the exception of the absorption process, are manipulated by mechanical contrivances such as pressure pumps, vacuum pumps, and air compressors, and can be controlled to suit the wood structure, while in the absorption process the treatment is governed by temperature and atmospheric pressure, therefore is limited to certain woods.

Burnettizing Process: This is often referred to as the zinc chloride process and consists of impregnating the wood fibres with a solution containing one-half pound of dry zinc per cubic foot of wood and is operated as follows:

The wood is first air seasoned in the open, or steamed in retorts to expel the moisture; then a vacuum is produced and maintained until the solution is introduced and the wood completely submerged. By pumping in additional solution the pressure is then increased to about 100 lb. or 125 lb. per sq. in., until the required penetration and impregnation is obtained, when the remaining solution is drained from the retort.

Total time required to treat ties, omitting time of steaming, is about.....	3½ hrs.
Total time required to treat ties including steaming time is	5 to 7½ hrs.
Total time required to treat timber, omitting time of steaming is	4 hrs.
Total time required to treat timber, including steaming	8 to 12 hrs.

Wellhouse Process: This is often referred to as the zinc tannin process and consists of impregnating the wood fibres with a hot solution containing about one-half pound of dry zinc chloride plus one-half per cent of glue or gelatine per cu. ft. of wood, then following by injecting a second solution containing one-half per cent of tannic acid. The purpose of the tannin is to solidify the first injection to prevent leaching and is operated as follows:

The wood is first air seasoned in the open or steamed in retorts to expel the moisture. A vacuum is then produced and maintained until the solution is introduced and the wood completely submerged. The pressure is then increased to about 100 lb. or 125 lb. per sq. in. by pumping in additional solution until the required penetration and impregnation is obtained, when the remaining solution is drained from the retort and the second movement takes place by filling the retort with a solution containing one-half per cent of tannic acid and increasing the pressure by pumping in additional solution at about 100 lb. or 125 lb. per sq. in. until the required penetration is obtained, when the solution is again drained from the retort.

Total time required to treat ties, omitting steaming is about	4½ hrs.
Total time required to treat ties, including steaming is about	6½ to 8½ hrs.
Total time required to treat timber, omitting steaming is about	5½ hrs.
Total time required to treat timber, including steaming is about	9½ to 13½ hrs.

*Read before the Western Society of Engineers.

Absorption Process: This is often referred to as the non-pressure process and consists of submerging the wood in a boiling preservative at a temperature of about 230 deg. Fahr., and then treating it with a cold preservative as follows:

The wood is first air seasoned in the open to reduce the moisture, then placed in either an open or closed receptacle where it is submerged in a hot preservative which expels the air and additional moisture. The receptacle is then drained and the wood submerged in a cold preservative. The first movement opens the pores or cells of the wood, forming a vacuum within, while the second causes absorption due to the difference in temperature and atmospheric pressure. This process can be used in either open tanks or closed retorts. For treating the butts of poles, fence posts, piling and small quantities of ties, the open tank is satisfactory, but for treating large quantities of material the closed retort is recommended where careful impregnation is desired.

The time of treatment is as follows:

For green timber:

Boiling in hot preservative from 8 to 10 hours.
Bathing in cold preservative from 8 to 16 hours.

Total time of treatment 16 to 26 hours.

For seasoned timber:

Boiling in hot preservative from 3 to 6 hours.
Bathing in cold preservative from 4 to 8 hours.

Total time of treatment 7 to 14 hours.

With this process it is possible to impregnate a limited class of woods with about 6 to 12 lb. of creosote oil per cubic foot.

Full Cell Creosote Process: This consists of impregnating the wood fibres and cells of ties with six to twelve pounds of creosote oil per cubic foot and timber and piling with 10 lb. to 20 lb. of creosote oil per cubic foot, as follows:

The wood is first seasoned in the open or steamed in retorts (generally both) to reduce the moisture and expel sap, then a vacuum is produced and maintained until creosote oil is introduced and the wood completely submerged. The pressure is then increased to about 100 lb. to 125 lb. per sq. in. and maintained until the desired penetration and impregnation is secured, when the remaining creosote oil is drained from the tanks. In some cases a vacuum is produced and maintained at the finish to drain the surplus oil from the exterior of wood to prevent loss by dripping after wood has been removed from retorts.

Total time required to treat ties, omitting steam-

ing 3 hrs.

Total time required to treat ties, including steam-
ing 5 to 7 hrs.

Total time required to treat timber, including steam-
ing 7 to 11 hrs.

Total time required to treat piling, including steam-
ing 12 to 24 hrs.

Rueping Process: This is often referred to as a partial cell treatment and it is used principally in connection with creosote oil. It consists of forcing compressed air into the pores or cells of the wood and at a higher pressure creosote oil without relieving the air pressure. Upon relieving the combined pressure the air expands and forces out surplus oil, leaving the wood fibres impregnated as follows:

The wood is first air seasoned in the open or steamed in retorts (sometimes both) to reduce the moisture, then a vacuum is provided and the air is compressed to from 80 lb. to 100 lb. per sq. in., thus filling all the wood cells with compressed air; and, by air equalizing reservoirs or pumps, the retorts are filled with oil without releasing the air pressure. The oil pressure is thus started at from 80 lb. to 100 lb. per sq. in. and gradually increased to about 100 lb. or 150 lb. per sq. in., having the effect of compressing the air in the cells to a smaller volume and permitting about 10 lb. to 12 lb. of creosote per cubic ft. to enter. The pressure is then released and oil drained from the retorts. A vacuum

is then produced, which causes the air within the cells to expand and forces the surplus oil out of the wood, leaving the wood fibres impregnated with from four to six pounds of creosote per cubic ft. This process is best adapted for treatment of ties.

Total time required to treat ties, omitting time of
steaming 4½ hrs.

Total time required to treat ties, including time of
steaming 6½ to 8½ hrs.

Lowry Process: The Lowry process is a partial cell treatment process, it being used in connection with creosote oil. It consists of forcing creosote oil into the wood cells, and then drawing it out by vacuum, the surplus oil leaving only the wood fibres impregnated as follows:

The wood is first air seasoned in the open, then placed in retorts and submerged in creosote. The pressure is then applied and 10 lb. to 12 lb. of creosote per cubic foot forced in at about 180 lb. pressure so as to saturate the pores and cells, after which the retort is drained and a quick vacuum produced and maintained from one to two hours, leaving the wood fibres impregnated with from four to six pounds of creosote per cubic foot. This process is used principally in the treatment of ties.

Total time required to treat ties, four to six hours.

Card Process: This method of treatment consists of impregnating the wood cells with an emulsion consisting of zinc chloride and creosote oil, as follows:

The wood is first air seasoned in the open or steamed in retorts (generally both) to reduce the moisture and expel the sap. Then a vacuum is produced and maintained for one hour, when the retort is filled with a hot emulsion consisting of one-half pound of dry zinc and from 1½ to 4 pounds of creosote per cubic ft. The pressure is then applied by forcing in additional emulsion at about 100 lb. to 150 lb. per sq. in., after which the retort is drained and a vacuum produced and maintained for about 30 minutes to draw the surplus emulsion from the exterior of the wood to prevent loss by dripping when the wood is removed from the retort.

It is necessary to keep the emulsion constantly agitated to prevent a separation of the zinc and creosote and to accomplish this a centrifugal pump draws the emulsion from the top of the retorts and discharges it into the bottom through a perforated pipe. This process is used principally in the treatment of ties. Total time required to treat ties, including steaming, 6 to 8 hours.

Remarks: There is a great diversity of opinion among engineers and operators as to what is the best process or preservative to use, however, it is reasonable to assume that the foregoing are receiving the most favorable consideration by the leading railroads throughout the world and especially in this country.

The question of treatment is resolved to a matter of investment and to secure the best results, the wood must be treated so that the chemical life will be equivalent to the mechanical life. Therefore, in considering this vital problem, the mechanical arrangements should be just as important as the treatment. In many instances the initial cost of treatment has been the important factor and the first cost of treatment will assume the following rotation:

1. Burnettizing process.
2. Wellhouse process.
3. Card process.
4. Rueping and Lowry processes.
5. Absorption.
6. Full cell process.

The full cell creosote process is the most expensive in first cost and is probably considered the very best for all conditions. It is particularly adapted for treatment of piling and timber, whereas the others are being used the most extensively in the treatment of ties.

The absorption process is advocated by some engineers as

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a very cheap installation and satisfactory treatment for general work and where small quantities are to be treated and time is of no consequence, but it is not a thorough success for plants that handle large quantities and where absolute control of treatment is desired. To secure uniform impregnation, it is obviously necessary to use mechanical apparatus. From modern practice it is evident that the partial treatment for ties and full cell treatment for piling and timber is the most favorable among consumers.

It may be of interest to you gentlemen to know what the different railroads and commercial companies are doing throughout the United States. It is always best to start at home. The P. R. R. took up this matter about two years and a half ago, since which time they have installed a plant at Mt. Union, Pa., shown in Fig. 12, and another at Greenwich Point, Pa., just outside of Philadelphia. Each one of these plants will treat 500,000 to 600,000 ties a year. They are treating at Mt. Union mixed oak, beech, birch, gum, etc., and at the Greenwich Point plant principally sap pine and gum ties, timber, piling, poles and some blocks. Their present practice is to use from 8 lb. to 10 lb. of creosote per cubic foot in treating ties.

The B. R. & P. started a plant at Bradford, Pa., in June. It is a small plant, having a capacity of about 300,000 to 400,000 ties per year, and they intend using from 8 lb. to 12 lb. of creosote per cubic foot in their ties and 10 lb. to 16 lb. in their bridge timbers.

The Eppinger & Russell Company's plant at Jacksonville, Fla., is a commercial plant and they are treating ties and material for the New York Central Lines, the Southern, Seaboard, the Atlantic Coast Lines, the Long Island, N. Y., N. H. & H. and many others. They also do a lot of foreign work for shipment to Cuba and the South. They are able to treat with any process, but to date they are using the full cell process in nearly all their work, 10 lb. to 12 lb. of oil for ties and from 16 lb. to 24 lb. in piling.

The Somerville, Tex., plant of the Santa Fe is possibly the largest plant in the United States, for they treat about 15,000 ties a day. They have installed the Rueping pro-

cessing the zinc chloride process. In fact Mr. Isaacs, the consulting engineer, was the original patentee of some of the machinery used in the process and great credit is given him for working up the original plants.

The Salt Lake Route has a plant at San Pedro, Cal., using the zinc chloride process. The cerosoting treatment on the Pacific coast is somewhat different from other places. The Pacific Creosoting Co. at Eagle Harbor, near Seattle, Wash., is using the boiling process and it seems to be the only process that is satisfactory for treating fir timber, for it is a very difficult wood to treat. The fibers and cells are constructed differently from those of the woods we have in the East and South and there is so much pitch in the wood that it is hard to penetrate and in order to secure thorough penetration they find it necessary to immerse the wood in creosote, gradually heating it to a temperature of from about 180 deg. to 225 deg. and maintaining boiling temperature from 10 to 30 hours, depending on the wood. Thus they boil out the moisture and sap and then treat it with either the Rueping or the full cell process, principally the latter. They are treating material for China, Japan and South America and for the railroads and dock companies along the Pacific coast.

To show how important it is to creosote piling on the Pacific coast, an untreated pile in San Francisco bay will only last about nine months. If it is creosoted with only 10 lb. to 12 lb. of oil per cubic foot it will last 10 to 20 years. They have creosoted piling in the Southern Pacific wharves that has been in place 10 years, and untreated piling near by has gone out in less than a year. The teredo attacks internally, below the low water line, and above the low water line the limnoria externally.

The Chicago & Northwestern, at Escanaba, Mich., is using the Card process. It used the Wellhouse process for a good many years, but gave it up some time ago for the Card process. They use $\frac{1}{2}$ lb. zinc per cubic foot in a solution of water and oil, the oil amounting to about $1\frac{1}{2}$ lb. to 4 lb. of oil per cubic foot, depending on the material.

The Chicago, Milwaukee & St. Paul is using the Card process and having the material treated by the Chicago Tie &

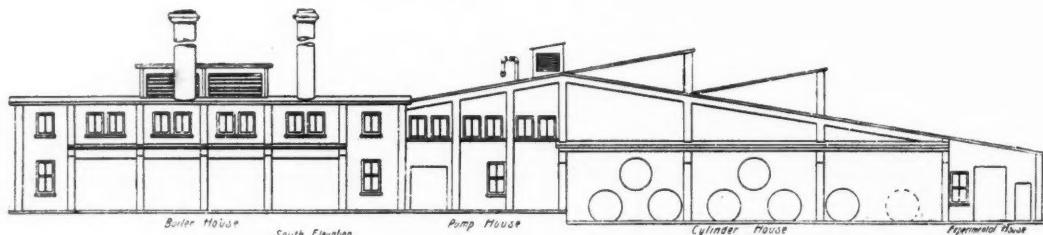


Fig. 15.

cess, using four to six pounds of creosote per cubit ft. They also treat considerable timber and piling. The Santa Fe also has a plant at Albuquerque, N. M., where it is using the Rueping and full cell processes and is experimenting with crude oil treatment using California crude oil plus 30 per cent of creosote, and gets a very good treatment.

The Illinois Central purchases a great many of its treated ties from the Ayer & Lord Tie Co., which has plants at Carbondale, Ill., Argenta, Ark., and Grenada, Miss. They are using the Burnettizing, Rueping and full cell processes, depending on where material is used. In the North they use the lighter treatment for the reason that in the South the tie will last less than half as long as it will in the North.

The Southern Pacific has one plant at Los Angeles, Cal., one at Oakland, Cal., and another in Oregon. They are treating ties with $\frac{1}{4}$ lb. to $\frac{1}{2}$ lb. zinc chloride per cu. ft. It gives a cheap Burnettizing treatment and they seem satisfied. It is one of the oldest railroads in the United States

Timber Co., Mr. Card, the patentee. He also has a plant at Terre Haute, Ind., using the same process.

The C. B. & Q. has a plant at Galesburg, Ill., in which it uses the Card process for ties; and full cell process, using creosote, for timber. It has another plant at Sheridan, Wyo., using the Burnettizing process.

Some of the principal commercial plants are the National Lumber & Creosoting Co., and the International Creosoting Construction Co., Texarkana, Tex.; the United States Wood Preserving Co., the Norfolk Creosoting Co., and the Atlantic Creosoting Co., Norfolk, Va.; the Eppinger & Russell Co., Jacksonville, Fla.; the Gulfport Creosoting Co., Gulfport, Miss., and the Kettle Rivers Co., Madison, Ill. The plant of the Texas Tie & Lumber Preserving Co.'s plant at Somerville, Tex., is shown in Figs. 13 to 19 inclusive.

The question of treatment depends entirely on the location of the ties or timber, the load on the tie, whether you are going to use tie plates, screw spikes or ordinary spikes,

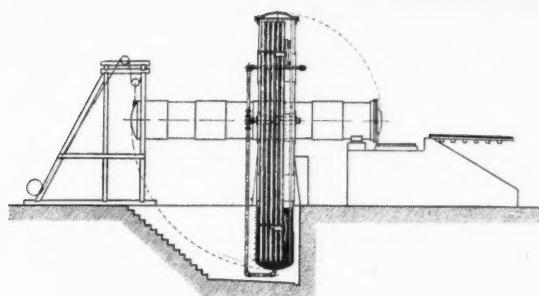


Fig. 20.

etc. It is reasonable to assume that if you have a light load on the rails, a small tie with a light treatment can be used. If a heavy load on the rails, a large tie and tie plates with heavier treatment, equivalent to the mechanical life. In other words, the chemical life should be equivalent to the mechanical life. Selection of processes in many cases is a matter of opinion. But we know that creosote will increase the life and it has been used in this country for a great many years. Further, in Europe, ties have been in the road thirty years.

There are several new processes that have come up in the last few years, among which I might mention the creosote-calcium process, which consists of the elements of creosote, together with lime in a solution. That is a patented process now advocated by the Blagden & Waugh Co., of London. They have been experimenting in our country with some of the railroads, but it has not yet been favorably considered.

istence. They have a very complete equipment and are putting all these different kinds of wood and treat them with different processes and put them in this pit, thereby being able to tell within three or four months which is the most valuable.

The treatment of telephone and telegraph poles is very important. You have all probably noticed that the poles throughout the country will begin to decay at the ground and within three or four years they will rot away until they are only three or four inches in diameter. There is a new method of treating poles which is going to be very successful. It is the Logan system, see Fig. 20, and consists of putting the pole in a closed horizontal cylinder, then tilting the cylinder up on end and allowing the oil to go into the bottom up to any height desired, five, six or eight feet; then put an air pressure on top of that oil, which keeps the oil at uniform height and force the oil in with a pressure pump until you get the desired penetration. With this new process they can treat 1-3 or 1-5 of the pole, thereby effecting a considerable saving.

Poles in the ground can also be protected if they go at it in time by the Lamb process, which consists of digging around the pole and putting in a form and pouring asphalt mixed with creosote into this form and placing a collar of concrete at the ground level. That has been tried on the Pennsylvania Lines and seems to be much in favor.

The producers of creosote in the United States, up to a few years ago, were unable to make creosote oil of standard specifications as compared to that secured in England and Germany. However, the producers in the United States now agree to make creosote oil to any reasonable specifications, the same as European oils. In fact about 35 per cent of

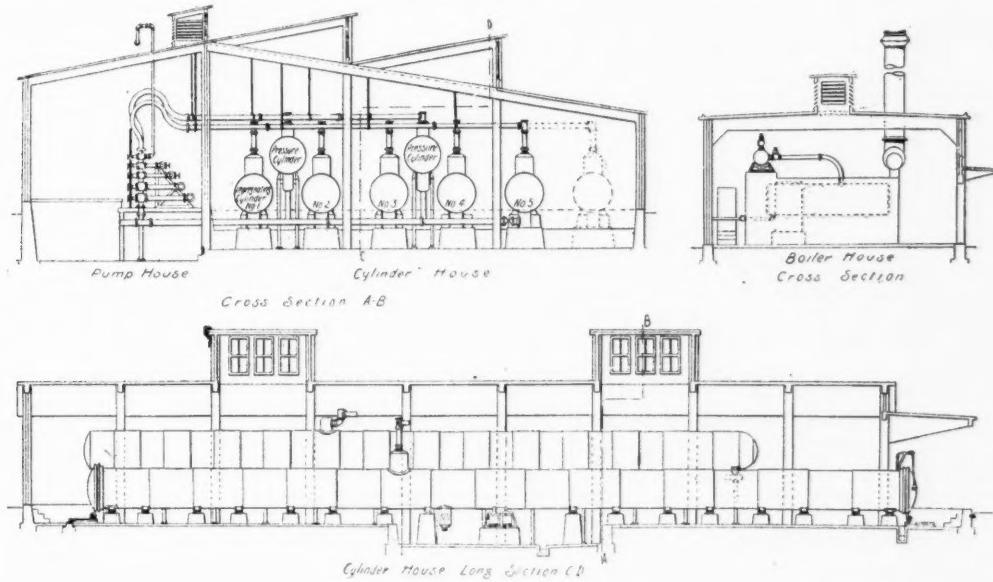


Fig. 14.

Another process consists of a mixture of sulphur and lime, ting in a fungus pit, which means that they can then take boiled into the wood. Then there is the vulcanizing process, which consists of coagulating the sap and vulcanizing under high temperatures. It is claimed that with this process the spikes hold better and it increases the strength of the tie.

The only way we can find out whether these new processes are going to be of value is to make a comparison test in a fungus pit. They have several in Europe and we now have one at the United States Forestry Department experimental laboratory at Madison. The Madison plant is one of the best equipped experimental laboratories in ex-

the oil is produced in the United States now and they are making arrangements to produce more.

The creosote oil that is brought to this country is brought over in tank steamers. It is kept at a temperature of about 125 deg. to 135 deg. Fahr., and delivered in tanks at Philadelphia, New Orleans, Galveston, Gulfport and Jacksonville, Fla. Creosote oil costs, in the United States, from 6½ cents to 7 cents per gallon, on the coast.

The treatment of paving blocks in the United States is becoming very important. The cities of New York, Philadelphia, Cincinnati, St. Louis, Chicago, Minneapolis and many of the western cities are taking it up very rapidly. Some

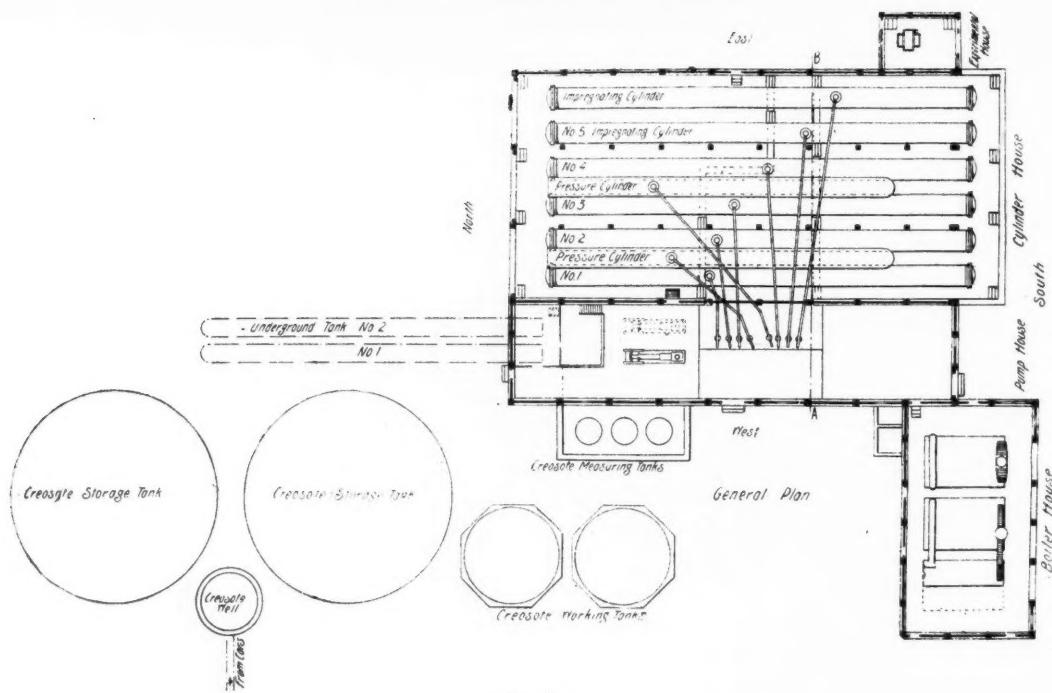


Fig. 13.

plants are devoted exclusively to the treatment of blocks and there have been some blocks put in the streets of Pittsburgh, I believe.

High pressure will have a tendency to fracture the fibers of the wood. The usual practice throughout the United States is to use not over 200 lb. pressure per square inch on the timber. There have been some tests made at higher pressures and they have found that the high pressures do fracture the fiber. The full cell creosote process will have an average pressure of about 180 lb. to the square inch.

G. S. Davison: I would also like to ask if I understood aright that the teredo attacks the pile between high and low water. I had understood that the teredo does not attack piling above low water mark but remains several feet below.

G. B. Shipley: Possibly I did not explain that in detail. The teredo will attack the pile as high as 18 in. above low water mark. The limnoria attacks it between low and high water level.

A. R. Raymer (assistant chief engineer, P. & L. E., Pittsburgh): It is very difficult to get good ties and the difficulty is increasing from year to year. Mr. Shipley is very modest in speaking of the work he has done as he has installed, constructed, and put in operation, many of the plants he has been speaking about tonight.

About a year ago I had the pleasure of visiting Mr. Crawford, president of the Tennessee Coal & Iron Co., of Birmingham, Ala., formerly of McKeesport. He said that when he took charge of that property the visible supply of timber for their mine and other work at that place would last only seven years. In the short time he has been there he has inaugurated a timber treating plant and a system of reforestation by which the same supply of timber will last his company perpetually. This gives an illustration of the importance of taking care of the timber and preserving it.

I came here tonight seeking information, not to give it. Our company has done very little so far in treating ties.

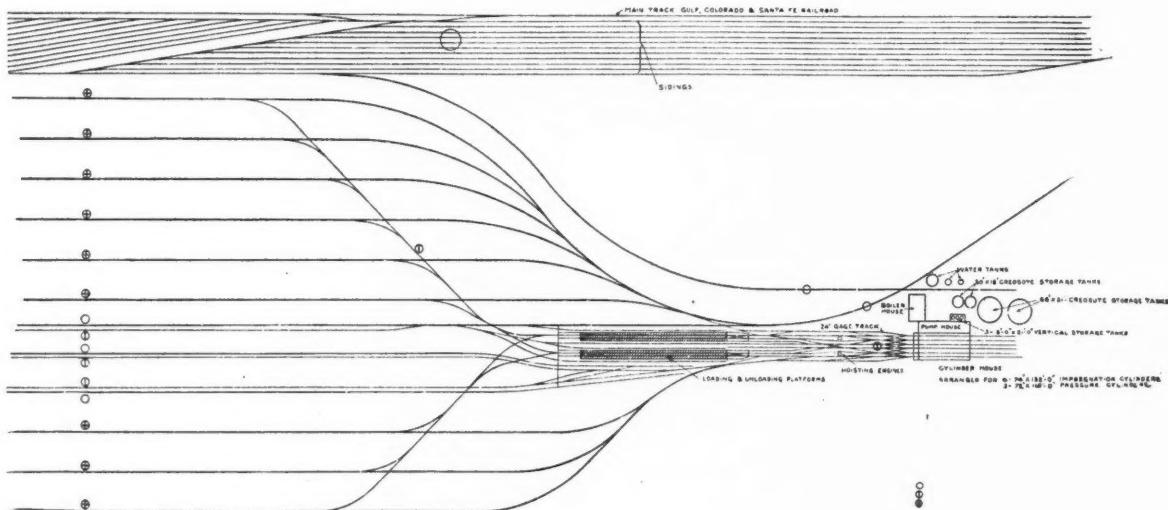


Fig. 16.

The bridge ties on the Ohio river bridge are treated. We treated them by the open tank process, using steam coils and carbolineum avenarius, a German product, heated to a temperature of about 200 deg., in which green, freshly sawed white oak ties were treated. It cost the company considerable money but it is estimated that if the life is prolonged as we expect it will be, the investment will be very profitable.

V. R. Covell (deputy county engineer for Allegheny county, Pittsburgh): The use of treated timber has not been extensive in the Pittsburgh district. One or two short stretches of street pavement and a few bridge floors will include about all that has been used. In 1909 the county engineer's office adopted the policy of using only treated timber in the floor systems of old bridges where all timber must be renewed. The three county bridges, Monongahela river bridge No. 1, Allegheny river bridge No. 1, and Ohio river bridge No. 1, built recently or now building, are designed with treated wood block paving. There has been difficulty in getting reasonably prompt delivery of material. Sufficient time has not elapsed to determine the value of the treated timber in this construction.

G. B. Shipley (answering a question): Beech timber can be treated about the same as mixed oak. It has about the same structure, and takes about the same treatment; it will make a good tie and last about as long.

Willis Whited: Referring to the open tank process of impregnating timber, I got the impression somewhere that the fumes are almost fatal, at least very injurious to men working around it.

G. B. Shipley: I think you are mistaken, because it seems to benefit people working around the plant. You will find it very difficult though in breathing the hot fumes. In treating, the creosote is forced into the wood under high temperatures and upon opening cylinder doors, the hot fumes blow out from the cylinders and vaporize, usually saturating the operator's clothes and everything else, but it is not injurious to the health. If creosote oil contains acids, then it will slightly burn your face.

V. R. Covell: What effect does the increase or decrease of specific gravity have on the quality of the product? In the discussion of the paper, "A Review of Chicago Paving Practice," in Vol. LXVI, of the Transactions of the American Society of Civil Engineers, a quotation from Captain John C. Oakes, U. S. A., is as follows: "An oil having a specific gravity as a whole of more than 1.07, should be looked on with suspicion and investigated. Unless it is almost wholly lacking in low-boiling fractions, it possibly has some hard pitch or undistilled coal-tar mixed with it."

G. B. Shipley: Some persons claim it contains a higher percentage of solids, and if I am not mistaken, it does contain as much antiseptic qualities as the creosote containing about 1.04 to 1.07. It takes a higher pressure and a higher temperature to penetrate the wood.

N. S. Sprague (superintendent, Bureau of Construction, Department of Public Works, city of Pittsburgh): The question raised by Mr. Covell about the specific gravity of creosote oil for the treatment of wood block pavements was very thoroughly discussed at a convention of municipal engineers held in Chicago about a year ago, for the purpose of standardizing paving specifications. The committee charged with the preparation of specifications for creosoted wood block pavements held a conference with representatives of some of the creosoting companies and listened to their side of the argument relative to the proper value of the specific gravity of this creosote oil. The question was given very careful consideration and this committee had the assistance and advice of some of the best chemists that could be obtained, and after a very careful review of the data, recommended a specific gravity for this creosote oil of 1.10.

During the past year this committee, of which the writer is a member, has been subjected to considerable criticism by certain companies and individuals on account of the limiting value of the specific gravity of the creosote oil adopted by this convention. Certain of the companies in this country engaged in the treatment of wood block for pavements alleged that creosote oil having a specific gravity of 1.10 could not be obtained except from one corporation, in other words, the product was controlled by one company.

The American Society of Municipal Improvements recently appointed a committee to prepare standard specifications for creosoted wood block pavements. As the time allowed this committee for the preparation of a report was so limited the committee decided to adopt tentatively the Chicago specifications with some slight modifications. This committee felt, in view of the recent criticism, that the matter of the value assigned to the specific gravity of the creosote oil should be investigated, with a view of determining whether or not the statements made by certain of the creosoting companies, to the effect that the product was controlled by one company, was true. Mr. A. W. Dow, of the firm of Dow & Smith, of New York, a member of the American Institute of Chemical Engineers, and chairman of this committee, reported, after making many searching inquiries, that creosote oil having a specific gravity of 1.10 could be obtained by any one having the necessary capital. As this part of the report was left in the hands of the chairman of the committee, I personally did not inquire into the matter and endorsed the report of the committee. Today I received a letter from the Wyckoff Pipe & Creosoting Co., asking me for information as to where they could obtain 200,000 gallons of creosote oil having a specific gravity of 1.10. In view of the foregoing, it appears that the question relating to the proper value of the specific gravity of creosote oil for the treatment of wood block pavements is worthy of further consideration.

In my opinion, the quantity of preservative treatment for timber should be determined by the character of the wood to be treated and the uses for which it is intended. For example, in the case of wood block pavements the quantity of preservative used should be determined by the amount of traffic to which the pavement would be subjected, rather than by an arbitrary fixed amount. The wood block pavement subjected to heavy traffic requires a less amount of preservative than a wood block pavement laid on a residence street or alley where the traffic is light and is used for only local needs. The treated block in the first instance will wear out before it will rot out, while in the latter case the wood will decay before it wears out, and therefore a larger percentage of preservative should be used in treating the wood.

With respect to the quantity of treatment for railroad ties and lumber used for structural purposes, it appears that a preservative treatment of ten to twelve pounds of oil per cubic foot prolongs the life of this material several years. Would it not be economy to use a larger percentage of preservative at a relatively small additional cost and thus prolong the life of the wood a few years more?

Albert Kingsbury (consulting engineer, Pittsburgh): I was concerned in the installation of a steam plant in 1892 which included underground steam pipes connecting a system of buildings for heating purposes. The pipes were placed underground in wooden boxes, and the manholes and manhole covers, placed at intervals along the steam lines, were also made of wood. This wood was treated by what was called at that time the Kyanizing process, which I understood to be a mercuric chloride treatment. The wood was second growth white pine of a rather poor grade with a good many knots and some sap wood. The variety of conditions under which the wood was used gave as wide a range as one

February, 1911.

could expect to find for testing the effectiveness of the preservative process. There was a good deal of moisture present at all times as the ground waters had pretty free access to the wooden boxes and around the manholes; and the heat from the steam pipes heated the wood to various temperatures from the lowest winter temperature up to the charring point. I had ample opportunity to note the condition of this wood during the first seven years after it was put in and during that time I do not recall having noticed anything in the way of decay. The wood appeared to be somewhat more brittle as a result of the treatment than it otherwise would have been, but aside from that I noticed no deleterious effects of any kind. I have lately learned, however, that all the wood has been replaced by other material, the last being replaced in 1909. The tops of the boxes were not Kyanized, and all these planks rotted out. The bottom planks also rotted, apparently because of the large amount of water which ran along the bottoms at certain seasons, probably dissolving out the mercuric chloride. The sides of the boxes were fairly well preserved.

N. S. Sprague: In the treatment of piles, where from sixteen to twenty-four pounds of creosote oil is used, have you ever had any trouble or complaint due to the oozing out of the oil after the piles have been in service? Wood block pavements have caused serious trouble due to the oozing out of the preservatives after the pavements have been laid, requiring the application of hot sand and a thorough scraping and cleaning.

G. B. Shipley: In treating the piling it is customary to season or steam the material, and if the vacuum fails to take out all the water there is a tendency, in forcing in the creosote, to meet resistance which results after driving in the water with some creosote oozing out through the center of the timber and the top showing that material was not properly treated.

V. R. Covell: Is it more economical to treat Southern timber in the North? Thus far the timber furnished, under contract for the repair of county bridges, has been treated in the south; and is it not difficult to determine accurately the weight of oil per cubic foot that is forced into the timber?

G. B. Shipley: Answering the last question first, no, it is not. The question of where is the best place to have the material treated I think resolves itself into the question of transportation. If you go south for timber and ship north for treatment, you could save considerable on freight. For instance, if you are treating 16 lb. to cubic foot, you will save 16 lb. per cubic foot in freight which means considerable on long distance transportation.

The question of determining how much oil per cubic foot is in the treated material depends on the honesty of the operator. You can put a certain amount of oil in certain timber and by carefully manipulating your treatment you can get your oil into the wood, providing you know in the first place how much that wood will take. But the best way to determine how much oil is in the wood is first of all to weigh your material as it goes into the cylinder, then weigh the oil as it is forced into the wood, and afterwards weigh your material as it goes out of the cylinder. In that way you will have two checks; you will have a check on the amount of oil you put in as it goes in with the force pump, and then also as it is finally weighed after treatment. There is going to be a slight variation, but it should not be over 5 per cent.

The only way is to measure or weigh the creosote as used or forced into wood. If you measure the creosote, you must compute for temperature, for creosote oil will expand and contract about one per cent for each 22 degrees difference in temperature.

H. R. Bickle (chief engineer, Fort Pitt Bridge Works, Pittsburgh): One wood absorbs more oil than another. Lob-

lolly pine absorbs more than the other hard woods. Would that not, therefore, be a better material to use for pavement than long leaf, though not quite as hard as long leaf? The oil being almost as essential in block pavement of streets as wearing quality in order to counteract the chemical action of foreign substances.

G. B. Shipley: It is not as hard. Long leaf yellow pine is a better wearing wood.

R. A. Cummings (consulting engineer, Pittsburgh): Some time ago, while in New Orleans, I noticed that many of the electric light poles which had been treated, decayed badly at the top while the remaining portion of the poles, down to the ground level, appeared to be perfectly sound.

F. M. Bond (engineer in charge, Forest Products laboratory, U. S. Forest Service, Madison, Wis., by letter): In regard to the relatively high treatment pressures: It is hardly probable that any pressure that may be obtained in a treating cylinder could of itself break down the cells of seasoned or unseasoned wood. As has been already pointed out in Mr. Winslow's paper, when timber is properly seasoned, either in the open air or by the ordinary artificial means, the cells have been found to develop slits through which air or liquid may pass. It would, therefore, seem that there is little chance of any marked difference in pressure existing within the structure of properly conditioned wood. In the case of green wood, if consideration is taken of the fact that the compressive strength of green wood varies roughly from 3,000 to 5,000 lb. per sq. in., based upon the total area, including air spaces, etc., that its tensile strength is even greater and that the actual wood fiber is only a part of this area, it will be at once seen that the actual strength of wood fiber must far exceed the strength necessary to withstand any pressure that might be obtained in a treating cylinder. Further, the following quotation from Bulletin No. 107 of the American Railway Engineering and Maintenance of Way Association, page 103, is submitted:

"The tracheids with these peculiar valve-like pits are apparently capable of withstanding an enormous pressure. In the living cells, the pressures due to osmosis frequently amount to three or four atmospheres, and it is stated by Strassburger that a pressure as high as eight atmospheres (120 lb. gauge) have been measured. Livingston states that the pressure may vary from two to more than a hundred atmospheres (1,500 lb. gauge) within living cells."*

It would appear, therefore, that the breaking down of the wood structure, when high pressure has been used, was due to some other cause than the pressure itself; without specific details, it would be impossible to assign the exact cause.

Relatively high specific gravity in coal-tar creosote is ordinarily obtained either by distilling off some of the lighter fractions or by the addition of pitch. The former method produces a creosote which is generally regarded as of superior quality, since it contains an increased proportion of the higher boiling or anthracene oils, and these fractions are generally believed to have a high antiseptic value. It has been found by analysis of treated wood that the lower boiling fractions, although they may be good antiseptics, remain in the wood but a short time on account of their high volatility when placed in the open air, and their low specific gravity and low viscosity when the timber is submerged. By boiling off the low fractions, however, the specific gravity of creosote can not be raised higher than about 1.08.

When the specific gravity of creosote is raised by the addition of pitch, its viscosity is increased so that higher temperatures are necessary in order to force the creosote into the timber. Moreover, pitch contains considerable free carbon which plugs up the outer spaces in the wood and retards the penetration of the preservative. It has also been found

*From a paper by Mr. Harry Donald Tiemann, engineer in timber testing, Forest Service.

that pitch, even after the removal of the free carbon, can not be forced much beyond the surface of the wood.

Treatment of paving blocks with creosote has for one of its objects, besides preserving the wood, the filling up of the wood structure with creosote to a large degree in order to reduce the amount of water that can be subsequently absorbed by the block. In this manner the expansion of the blocks is reduced considerably. Experiments by Dr. W. K. Hatt, of Purdue University, show that birch and larch paving blocks, treated with from 20 to 22 pounds of creosote per cubic foot, had their expansion due to the taking up of water reduced 50 per cent in comparison with untreated blocks of these same species. From this consideration, therefore, it appears unwise to reduce the amount of creosote ordinarily injected into paving blocks even when the pavement would be subjected to excessive wear under heavy traffic.

In regard to whether it would be more economical to use heavier treatments for railway ties than from 10 to 12 pounds per cubic foot: There is a large amount of data on treatments using this amount of creosote. These data show that where the treatments were properly applied, the amount of creosote was sufficient to preserve the ties for a period at least equaling their mechanical life. The tendency at the present time is to reduce this amount even with full-cell treatments; 8 to 10 pounds per cubic foot being the common practice.

The failure of the Kyanized pipe conduit, as described, was undoubtedly due to the leaching out of mercuric-chloride by the running water in the bottom of the trench. The use of mercuric-chloride, zinc-chloride and other antiseptic salts is confined almost entirely to timber placed in relatively dry positions, on account of the leaching action of water. Zinc-chloride is, however, often used for timbers placed in damp parts of mines where only a limited life of the timber is required and when this required life exceeds the natural life. Creosote would be the proper preservative to use in a pipe conduit because of its insolubility in water and its high antisepic quality.

Pitch is the only constituent of creosote which oozes out of treated timber to any great extent. The reason for this is that pitch does not penetrate beyond the outermost fibers of the wood due to its high viscosity and the free carbon usually contained in it. In paving blocks, where a high specific gravity is specified and this is obtained by the addition of pitch, the oozing out is usually considerable.

In regard to the use of loblolly pine for creosoted paving blocks: Since the blocks used in this country are usually four inches in depth and since practically any species of wood ordinarily used for this purpose may be thoroughly impregnated for this short distance by end penetration, the ease with which loblolly pine subjects itself to treatment would not increase its value as a paving block. Because of the short mechanical life of loblolly pine, its use as a paving material is not considered economical. A very similar species of wood has been used for this purpose in Paris, but it is said to have shown excessive wear, although a layer of coarse gravel was laid on the blocks and this became imbedded in the surface by the action of the traffic, thus increasing the wearing qualities of the pavement. In this country the use of longleaf pine, Norway pine and other hard conifers seems to be the most usual practice.

In the absence of specific data on the species, the treatment, etc., of the electric light poles whose tops have been found to show decay in New Orleans, it is impossible to assign a cause for this. Assuming that the poles were properly treated with a good coal-tar creosote and that they were previously properly conditioned, it seems that rot at the top of the pole must have been caused through the exposure of the interior part of the pole beyond the layer of treated

wood. If the holes for the cross-arm bolts were bored after the poles were treated or if the tops of the poles were cut off after treatment in order to make them of proper length, this would have given the fungous growth a sufficiently good means of entrance to cause decay. The top of the pole would be the most favorable of the upper part of the pole for decay to start, because, on account of its position, it is subjected to having lodged on it a greater number of spores of the wood-destroying fungi which are always present in the air. The top is also the part most exposed to the action of the weather.

The Forest Products Laboratory wishes to express its appreciation of the kind remarks by Mr. Shipley concerning its wood preservation equipment. Since a brief description of the apparatus and some of the experiments that are now being conducted in the laboratory may be of interest, I take this opportunity of bringing this to the attention of the society.

The laboratory has installed the following independent and complete equipments:

One cylinder 3 ft. 6 in. in diameter by 12 ft. long; maximum working pressure 300 lb. per sq. in.

One cylinder 18 in. in diameter by 4 ft. long; maximum working pressure 600 lb. per sq. in.

One cylinder 12 in. in diameter by 24 in. long coupled with one cylinder 8 in. in diameter by 18 in. long; maximum working pressure 300 lb. per sq. in.

Two open tanks 4 ft. by 12 ft. by 4 ft. deep for absorption treatments.

One underground fungus pit 11 ft. by 21 ft. by 8 ft. deep.

All of the pressure cylinders are equipped with steam coils or jackets, measuring tanks, pressure pumps, compressed air, vacuum and live steam connections. The large cylinder has, in addition to this equipment, two receiving tanks, one treating car, platform scales for weighing the charge before and after treatment and a centrifugal pump for keeping up a circulation when emulsions are used in the cylinder.

The fungus pit is divided into compartments which are kept under what is believed to be the most desirable conditions of light, heat and humidity for fungous growth. This pit is under the care of a pathologist detailed to the Forest Products Laboratory from the bureau of Plant Industry. Specimens to be placed in the pit are first sterilized and then inoculated with fungi.

By means of the fungus pit it is expected to force the growth of fungi in wood and in this manner obtain accelerated results. While such results may not be in all respects comparable to regular service tests they should at least give indication of the comparative value of different treatments and preservatives.

Some of the experiments now being conducted at the laboratory which would be of special interest are: An experiment in which five sets of specimens have been treated each by one of the five principal fractions of a good coal-tar creosote and are to be subjected to the action of marine borers in San Francisco bay and in the Gulf of Mexico. Other specimens of somewhat different form but treated in the same manner are to be subjected to the action of fungous growth in the rotting pit. By this means it is hoped to ascertain some indication of which fractions of creosote offer the greatest resistance to decay and to marine borers.

Another interesting experiment which is now being carried on in co-operation with the Chicago, Milwaukee & St. Paul is the treatment of 100 ties, each of red oak, and also the same number each of hard maple by a number of preservatives and different treatments, and subsequently placing these ties in the tracks of the railroad for a service test. Complete data are being taken on the peculiarities of each individual tie and its treatment. Sections are also being taken of one tie from each treatment and these sections will be subjected to fungous attack in the rotting pit.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

February, 1911.

Muckraking.*

The following correspondence speaks for itself:
Office of Rock Island Employees' Magazine,
La Salle Station, Chicago.

August 24, 1911.

Mr. Edward H. Clark, President,
International Magazine Company,
Publishers of the Cosmopolitan Magazine,
1789 Broadway, New York City.

Dear Sir: On page 464 of your September issue of Cosmopolitan in Mr. Samuel Hopkins Adams' article entitled "The Real Reason for High Prices," reference is made to over-capitalization of railroads.

In this connection you published this statement:

"But most of these great organizations are already paying heavy dividends on watered stock."

This generalization is frequently heard, and I am anxious to come into possession of authoritative specific information as to what railroads are over-capitalized, and the specific amounts of heavy dividends paid on this over-capitalization or watered stock.

I take it that your article above referred to on the "Real Reason for High Prices" has been well thought out, and that it will not necessitate a great deal of effort on your part or upon the part of your writer, Mr. Adams, to provide me with this information.

Awaiting your reply, I am,

Yours very truly,
(Signed) H. E. REISMAN,
Managing Editor.

Cosmopolitan Magazine,
381 Fourth Ave., New York, N. Y.
September 22, 1910.

Mr. H. E. Reisman,
Chicago, Ill.

Dear Sir: Replying to yours of August 24, which has just been handed to me, let me say that if you will address the Interstate Commerce Commission at Washington, I think that you will be able to secure all the information you desire.

Very truly yours,
(Signed) ROLAND PHILLIPS,
Associate Editor.

Office of Rock Island Employees' Magazine,
La Salle Station, Chicago.

October 12, 1910.

Mr. Roland Phillips,
Associate Editor, Cosmopolitan Magazine,
381 Fourth Ave., New York City.

Dear Sir: Replying to your letter of September 22 in answer to my former letter under date of August 24, inquiring for specific information in regard to which railways you referred to when you printed the statement that heavy dividends are paid on over-capitalized railways, including "most" of the great railroads of the United States, according to the article in a recent issue of Cosmopolitan.

Permit me to thank you for the suggestion that possibly I could get that information from the Interstate Commerce Commission at Washington.

May I in turn inquire if that is where you secured the information on which the article was based, or am I to believe by your evasion of the question that you haven't the information in hand to substantiate the declarations which you made in an apparently serious discussion of the subject?

Very truly,
(Signed) H. E. REISMAN,
Managing Editor.

*From the Rock Island Employees' Magazine.

No reply was received to this letter. You may decide for yourself whether Cosmopolitan Magazine had proof of their declarations.

THIRD ANNUAL REPORT OF THE BLOCK-SIGNAL AND TRAIN-CONTROL BOARD TO THE INTERSTATE COMMERCE COMMISSION.

At the date of the board's report of last year, plans and descriptions of 835 devices intended to promote the safety of railway operation had been submitted for examination and 511 had been examined and reported upon. During the past year 102 additional devices have been presented for consideration, making a total of 937 submitted to date. In numerous instances the proprietors of devices that have been unfavorably reported upon have submitted revised plans, covering later development of their apparatus calculated to remove the objections found to their original plans. It has been necessary to give these revised plans the same painstaking consideration as was accorded the plans submitted in the first instance.

During the past year the board has examined the plans and specifications of 308 devices, and has transmitted to the proprietor in each case a complete statement of its opinion regarding the merit and practicability of the device. Summing up, plans and specifications of 937 different devices and 48 modifications or revisions of plans originally presented have been submitted for the board's consideration. Of this number, 819 have been disposed of, leaving 166 cases now before the board for consideration. The great majority of these 166 cases are now in process of examination, but there are a considerable number in which complete information has not yet been furnished by the proprietors. The board has also received a mass of correspondence relating to devices concerning which no plans have been furnished. In many cases inventors, mistaking the functions of the board, have presented ideas looking to the development of some form of safety device and have requested the assistance of the board in embodying their ideas in a device that would perform the function intended in a practicable way. In all such cases the inventors have been informed that their ideas can not be considered unless presented in the form of plans and specifications showing in detail a practicable device designed to perform a useful function and clearly describing the manner in which that function is proposed to be performed. The board has always endeavored to assist inventors by pointing out defects in apparatus and offering suggestions for improvement, but it can not undertake to perform the functions of a consulting engineer.

Of the plans examined during the past year 91 covered signal and automatic train-control devices, 103 related to ties, rails, rail fastenings, switches, and other track appliances, 64 were devices relating to the construction and equipment of cars and locomotives, such as couplers, draft rigging, ash pans, headlights, etc., 30 related to adjuncts to the air-brake system and emergency brakes for cars, 9 were mail-bag catching and delivering devices, 7 were automatic hose connectors, and 4 were torpedo placers.

During the period from Nov. 1, 1909, to Nov. 1, 1910, the secretary of the board has received 3,360 letters, and during the same period 2,548 letters have been written relating to the work of the board and the devices under consideration. Six thousand copies of the board's second annual report and 2,000 copies of a report covering statistics of block-signal mileage, and mileage on which the telephone is used for the transmission of train orders, as of Jan. 1, 1910, have been distributed from the secretary's office. The statistics of mileage of railroads in the United States worked by the block system, with supplementary tables showing the kinds of apparatus and the methods of operation, together with

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the mileage on which the telephone is used for the transmission of train orders, were gathered by the board last January and published in pamphlet form. Steps have been taken to secure similar information as of Jan. 1, 1911.

Miscellaneous Devices.

Outside the field of signaling and automatic train-control the board has considered comparatively few devices that were believed to possess merit warranting special commendation or special action on the part of the board. While many of the inventions examined—particularly those relating to track—possess meritorious features, few, if any, have thus far been examined which would, in the opinion of the board, promote the safety of railway operation to any greater degree than similar devices now in common use.

Connectors.—Two automatic hose connectors have been held to possess merit warranting the conduct of practical tests under service conditions, and the board is informed that the proprietor of one of these devices is now endeavoring to procure the necessary equipment for test purposes. As noted in the board's last annual report, automatic hose connectors are now used regularly, but only to a limited extent, and their use still seems to be regarded as experimental. Some of the hose connectors that have been presented to the board for examination possess theoretically good features which would seem to render devices possessing them entirely practicable. One of the main reasons for failure of the railroads to adopt hose connectors, so far as the board can determine, seems to be the failure of manufacturers and designers of connectors to agree upon the specific form of connector contour that will fulfill the requirements of the situation. As was indicated by Mr. Willis C. Squire, in a comprehensive paper on the subject of automatic connectors for freight and passenger train cars, which was read before the Western Railway Club on Sept. 20, 1910, the conditions of operation that have to be met in the use of an automatic connector can best be obtained by a combination of the most practicable features and methods of support, contact, and registration now embodied in several of the types of connectors that have been in service for some time past. Mr. Squire states in his opinion that—

This combination is possible, is desirable, and will be accomplished when the connector manufacturers finally get together to decide upon standard form and features for manufacturing automatic connectors for freight-train and passenger-train service. When this condition of affairs is an accomplished fact, refinements of designs and the elimination of unnecessary parts and the simplification of the entire mechanical problem will be possible.

In response to a request from the board, the Long Island Railroad Co. has furnished the following information:

As far as this company is concerned, the history of automatic hose connectors is as follows: In November, 1902, 4 engines and 20 cars were equipped experimentally with the Westinghouse automatic air and steam couplers. These were of the side-port type, the couplers being held together by long bent springs at the side.

In the fall of 1903 all passenger locomotives and passenger cars were equipped with this automatic coupler. From the beginning a great deal of difficulty was experienced in keeping the couplers tight. It was found very hard to locate the hose terminals properly and to get a length of hose which, if moved in one direction, would not kink or would not be pulled in two when moved in the opposite direction. The sprung arms holding the coupler heads were found very difficult to keep at the proper tension, and screw jacks were provided to set these springs down occasionally. It was found that the gaskets became displaced and had to be replaced with considerable frequency. This is a very annoying feature, because, when trains were found in the train sheds with the gaskets leaking, they had to be cut in two to replace them on account of the construction of the coupler.

It was desired to increase the train-line pressure from 70 to 110 pounds on our passenger trains about 1908, on account of the introduction of the high-speed brake. It was found utterly impossible to do this with the original style of automatic connector, as the springs would not hold the pressure. The Westinghouse Automatic Air and Steam Coupler Co. then redesigned their connector so as to permit the use of a coil spring which was adjustable, so that a constant tension could be maintained. Therefore, in May, 1909, a complete new outfit of automatic connectors was purchased and installed on all of our passenger equipment. This resulted in greatly decreasing the trouble from leakage, but it was then developed that the automatic connectors damaged the hose somewhat when cars curved and a large increase was found in the number of burst hose.

At the present time the latest type of automatic heads are running on our passenger-train cars and locomotives with reasonable success. We find, however, that the leakage is much greater than with hand couplers and are of the opinion that there is no saving whatever in the cost of the hose. We are also doubtful as to whether the time saved by automatic connectors justifies

their expense in view of the fact that serious delays occur whenever it is necessary to change a gasket after a train is made up.

We consider the use of these connectors still in the experimental stage and are not fully prepared to recommend them for general use.

The Chicago & Alton Railroad Co. advises the board that two of its trains were equipped with automatic connectors some years ago, but that considerable trouble has been experienced on account of leakage, and the company is not contemplating any additional equipment.

The mechanical officers of the New York Central lines report that they have tested a number of different designs of connectors, but that as yet none has been found that will operate successfully under heavy traffic conditions.

Brakes.—In the field of train brakes no important development has taken place during the year. As previously stated, 30 devices of this character have been examined, but most of these were of such character that their use would introduce complications into the brake system as a whole and destroy its flexibility to such an extent that, even though their intended functions might be satisfactorily performed, their use would probably reduce the efficiency of the brake system as a whole and no increase in safety would be attained.

Two complete brake systems have been presented. One of these, that of the St. Clair Air Brake Co., of Indianapolis, Ind., was treated in the board's second annual report. So far as the board is informed, there have been no new developments in that system during the past year.

The other brake system is that of the California Valve and Air Brake Co., of Los Angeles, Cal. The distinctive feature of this device is that it retains all the advantages of the straight air brake and at the same time permits automatic application of the brakes. The disadvantage of being compelled to release, and thus lose braking power, while recharging the auxiliary reservoirs, as is necessary with systems now in use, is overcome, and the use of pressure-retaining valves is not necessary. In this system braking power is not affected by variations in piston travel or leakages in brake cylinder packing leathers, as pressure from the main reservoir is applied direct to brake cylinder pistons, and is thus not dependent upon variations in volume. Auxiliary reservoir pressure is used only in emergency applications of the brake, the triple valve being so constructed that in such applications the pressure stored in the auxiliary reservoirs flows into the brake cylinder and supplements train-pipe pressure.

This brake is reported to have been used to a limited extent on a western railroad, but the board has not had sufficient information respecting it to be able to pass a definite opinion concerning its merits. Before a final opinion regarding the merit of the brake can be given it will be necessary to test it in trains partially equipped with brakes of the types now in use, under the most severe conditions it is likely to be subjected to in actual service, so as to determine whether or not there will be synchronous action of the several types of equipment.

Headlights.—During the past year considerable discussion has taken place in regard to the use of locomotive headlights of high candlepower. In seven states, Arkansas, Montana, North Carolina, Oklahoma, South Dakota, Texas and Washington, locomotive headlights of 1,500 candlepower or over are required by law; in Indiana locomotive headlights of 1,500 candlepower or over are required by an order of the state railroad commission, and in Georgia the law requires electric headlights with 300 watts at arc and reflectors 23 inches in diameter.

The ordinary oil headlight commonly employed on locomotives is seldom powerful enough or maintained in a condition to make it more than a marker to indicate to persons at stations or railway crossings, or in yards or to trains on other tracks, that an engine is approaching. As a means of discovering or identifying distant objects on the track it has

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practically no value. The argument in favor of the high-power headlight is that persons or obstructions on the track may be seen by the light of a powerful gas or electric headlight at a sufficient distance to enable the train to be stopped before reaching them. On straight track the high-power headlight undoubtedly affords a degree of illumination, except in snow or fog, sufficient to enable an experienced engineman to distinguish unusual objects on the track at a considerable distance.

As headlights are usually fixed in position, their rays are projected in the direction of the axis of the locomotive, and hence on curves do not illuminate the track ahead. Various devices have been submitted to the board intended to impart to the headlight while the engine is rounding a curve motion to turn its beam so that it will fall on the track. Most of these devices are crude, and attempt to use the curving of the front truck of the locomotive as it passes around curved track to rotate the headlight. It seems unlikely that any apparatus of this kind can be made effective to meet all the conditions of reversed curves, tangents succeeding curves, and variations in curvature, that are found on many railroads, and it is probable that if full advantage is to be taken of the high illuminating power of gas or electric headlights on roads where much curvature exists, any motion of the headlight about its vertical axis must be within the control of the engineman.

Very strong objections are made to the use of high-power headlights, for the reason that the rays are so intense as to impair seriously for several seconds the vision of persons who may look into the beam. This effect, when experienced by enginem en of trains running in the opposite direction on parallel tracks, is considered by many to be serious. It has long been known that after a locomotive fireman has looked into the fire box for even a very few seconds in putting on coal the scotoma which persists for some seconds afterwards makes his reading of signals at night very unreliable until its effect has had time to pass off. As regards the effect of the high-power beam upon the vision of the men riding on the engine on which the electric headlight is used, it has been found in some rather extensive tests that the rays were sufficiently powerful to reflect back from the surfaces of the roundels of semaphore signals an amount of light sufficient to overpower the light transmitted by the signal lamps themselves. The spectrum of the electric arc is very rich in blue and green rays and contains a relatively small proportion of the red and yellow; hence, rays from the arc light reflected from the surface of the colored roundel would tend to diminish the resultant proportion of red in the light, and if reflected back from a green roundel would intensify its color. Very deceptive effects of this kind have been noticed by many observers, and while apparently such conditions may be dangerous as leading to erroneous reading of a signal light, they are largely counteracted by the fact that the high power of the light serves to reveal at a considerable distance the position of the signal arm. The usual rules governing enginem en in their interpretation of signal indications state that the indications will be displayed by day by positions of the semaphore arm, and in addition at night by lights of prescribed color, the effort being made to train the enginem en in so far as possible to depend upon position rather than upon color.

In the case of classification signals—that is, the colored lamps used on the front end of engines to indicate whether the train is an extra rather than a regular train, or whether it is running in two or more sections—the condition is much more liable to cause a misunderstanding of signals for the reason that classification signals are color signals purely, and are not signals of position. So difficult is it to read classification signals correctly when viewed in the beam of an electric headlight that railroads have made strenuous objection to their use on this account alone.

The whole question at the present time is in a highly controversial state. So far as opinion has at all crystallized, it appears to be as follows:

On single-track roads, particularly those in mountainous country or where fixed signals are infrequent, the high-power headlight on a train affords a warning of its approach for a considerable distance, and under favorable circumstances it enables the engineman to distinguish obstructions or unusual objects on the track much farther ahead than is possible with ordinary lights.

On double-track roads, and particularly on roads having three or four tracks and equipped with signals placed at frequent intervals, the prevailing opinion seems to be that the electric headlight is not only unnecessary, but is likely to cause serious errors on the part of enginem en in reading color signal lights.

Metal, concrete and composite ties.—Various forms of ties composed of material other than wood and designed to improve the condition of railway track, both with respect to economy and to safety of train operation, have been submitted to the board for examination. Important economic questions enter into the consideration of this subject. By the use of wooden ties placed in a roadbed properly ballasted and drained, and with adequate track fastenings, a safe track can be maintained. The main advantage, therefore, to be derived from the use of ties of material other than wood is decreased cost of maintenance and renewal. In the employment of electric track circuits in railway signaling it is necessary to insulate one rail from the other. An important difficulty with the metal tie is found in the problem of providing proper insulation. Another important matter in connection with the use of both metal and concrete ties is the difficulty of maintaining proper gage and surface under varying climatic conditions. In the winter season, in sections where there is considerable moisture in the ground, freezing causes the roadbed and track to heave, distorting the surface. In common practice this condition is met by blocking up or shimming the rails, or in some cases where short sections of track heave in winter, blocking is used between ties and rails in summer and removed gradually in winter as the ties heave. Metal or concrete ties can not be adzed to diminish their thickness nor can holes for bolts or spikes be bored in them at random for altering the relation of the rail to the tie so as to maintain proper gauge and surface. This is a problem which must be solved by the design of proper track fastenings. It is believed that the development of efficient devices of this character will hasten the development and more extensive use of metal and concrete ties. Up to the present time the development of concrete ties has not progressed as far as that of metal ties; this is believed to be due largely to the fact that much of the effort in concrete tie construction was made prior to the comparatively recent development of concrete composition, manipulation and reinforcement. It is probable, however, that when it becomes necessary to use other materials than wood, both metal and concrete will find large fields of usefulness in railway tie construction.

As a number of the ties which have been submitted to the board for examination are now in service, and have been used for a sufficient length of time to disclose their good and bad features and permit the formation of fairly accurate conclusions regarding their practicability, from the standpoints both of safety and of economy, the board appointed a committee, consisting of Chairman Cooley and Mr. Ewald, to make a personal examination of such ties in service. This committee has examined metal ties manufactured by the Carnegie Steel Company, installed on the Bessemer & Lake Erie Railroad and the Baltimore & Ohio Railroad; cast steel ties made by the Metal Ties Company, of New York, on the Baltimore & Ohio Railroad; also the Corell concrete tie in use on the Erie Railroad and on the

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International Railway, an electric road between Buffalo and Niagara Falls; and the Kimball composite tie on the Chicago & Alton Railroad.

Spark Arresters.—Several of these devices, designed to reduce the danger of fire set by locomotives along railroad rights of way, have been presented for examination. It is practically impossible to determine the merit of a device of this character from an examination of plans; it must be seen in actual operation under the most severe conditions it is likely to meet in actual service before an intelligent opinion concerning it can be formed.

Mr. C. A. McCotter, representing the American Spark Arrester Company, of Indianapolis, Ind., requested the board to send a representative to observe the operation of a device of this character at Purdue University, LaFayette, Ind. Mr. Ewald was delegated by the board to witness this test, which was made on July 26, 1910, under the direction of Prof. Louis E. Endsley.

Briefly described, the apparatus consists of a cylindrical, sheet-iron casing, its axis coincident with that of the smoke box, inserted in the smoke box of the engine. On the inside of this casing an inwardly projecting flange, about 15 inches wide, arranged spirally, acts as a deflector. Near the front end of the smoke box at the top an opening is left to allow the smoke to pass upward. The action of the device is such that by the time the smoke and cinders have passed through the spiral casing, the cinders will have lost their momentum and will fall to the bottom of the smoke box at the front end instead of passing up through the stack.

Two tests on the laboratory locomotive at Purdue were observed by Mr. Ewald, each covering a period of one hour. The first was made with lignite coal; no sparks were seen coming out of the stack. The second test was made with Indiana mine-run coal, of which 1,452 pounds were consumed. A speed equivalent to 20 miles per hour was maintained, and the average drawbar pull was 4,800 pounds. As the result of this test, 76 pounds of cinders were taken from the hopper. In addition, 8 pounds of very small cinders and soot were caught at the top of the stack in a metal receptacle having an area of 64 per cent of the stack. Means for disposing of the cinders had not been decided upon at the time of this test.

Locomotive Boilers.—Under date of May 23, 1910, the board received, through Secretary Moseley, of the Commission, a request to make an examination of an exploded boiler on the Pennsylvania Railroad to determine the cause of the explosion. In compliance with this request, Chairman Cooley proceeded to Altoona, Pa., and made an examination of the boiler. Through the courtesy of the officers of the Pennsylvania Railroad he was permitted to take portions of the ruptured sheets for the purpose of subjecting them to a chemical and microscopic test.

Under date of Sept. 21, 1910, the board, through Secretary Moseley, of the Commission, received a request from Mr. W. F. Buck, superintendent of motive power of the Atchison, Topeka & Santa Fe Railway, to witness a test of an improved form of fire box which was conducted at Topeka, Kan., on Sept. 26. The test was designed to demonstrate whether this particular form of fire box could withstand stresses which, in the ordinary form of fire box, in most cases produce ruptured sheets and result in so-called explosions. Mr. Ewald went to Topeka to witness this test. Mr. E. L. Gibbs, one of the commission's safety appliance inspectors, also was present on behalf of the board.

The Jacobs-Shupert fire box is made up of channel, or U-shaped, sections, bent to the desired form, placed flange to flange transversely of the furnace throughout its length. The sections are riveted together with a plate between the flange of adjacent sections. The shell of that part of the

boiler embracing the furnace is built up of similar channel-shaped sections, except that the web part of the channel of the shell sections is curved outwardly while the corresponding part of the furnace sections is curved inwardly, or toward the fire.

The intermediate plates embraced by the flanges of the channel sections extend from the furnace to the shell and are provided with openings for the proper circulation of water. The intermediate plates serve the double function of stay sheet and calking ring. For the latter purpose the edges of the flanges can be calked against the ring, and it is possible also to calk the edges of the ring against the channel flanges on the furnace side. Without the ring the flange edges of the sections would come together and the calking could not be done effectively.

With this construction the flanges and stay sheets are not exposed directly to the heat of the furnace, and the curved parts of the sections, which are highly heated, are suspended, as it were, from the ring sections formed by the flanges and stay sheets.

The test demonstrated that with the crown sections of the fire box raised to a temperature of 1120 degs. F. (the water being $4\frac{1}{2}$ inches below the crown sheet) the construction withstood safely a pressure of 220 pounds per square inch. Under similar conditions a fire box of ordinary construction would probably have failed.

Mail cranes.—A number of mail-bag catching and delivering devices have been presented to the board for examination. In view of the fact that the Post-Office Department has for many years conducted tests of these devices on its own behalf, and as the practicability of such devices to meet the needs of the Railway Mail Service is a matter that must necessarily be determined by that department, the board, with the approval of the Commission, consulted with the Superintendent of the Railway Mail Service relative to an examination of such devices, in order that there might be no conflict between the board and the Post-Office Department and no duplication of work. With this object in view, it was agreed with the Superintendent of the Railway Mail Service that the board's examination and report on such devices would be confined wholly to the question of safety in railway operation; and with this understanding the board agreed to submit its reports on such devices to the Superintendent of the Railway Mail Service, confining itself entirely to the question of safety.

On this understanding the board was informed that the Railway Mail Service was testing a device on the Chicago, Rock Island & Pacific Railroad between Omaha, Neb., and Davenport, Ia., and the board was requested to examine this device from the standpoint of safety and report to the Superintendent of the Railway Mail Service. Full information regarding the device was furnished by the superintendent and permits to enter postal cars for the purpose of examination were arranged for. Mr. Ewald was delegated to make this inspection, and he witnessed the operation of the device as installed on the Rock Island. His report to the board furnished the basis of a report which the board made to the Superintendent of the Railway Mail Service covering the safety features of the device.

(To be Continued)

THE USE OF DIAGRAMS FOR SOLVING ENGINEERING FORMULAE.*

GORDON F. DODGE, M. W. S. E.

A review of the technical press for the past year or so, leads to the conclusion that the engineering profession in general is giving increasing consideration to the graphical representation of data and solution of engineering formulae. Notwithstanding this apparently increasing tendency towards

*Paper read before the Western Society of Engineers.

the use of diagrams instead of inflexible tables, we in this country seem to be still considerably behind many foreign engineers in their application. Although there have appeared from time to time many diagrammatical solutions of complicated formulæ, there seems to be a dearth of information as to the method of constructing such diagrams, and it is the purpose of this paper to show how easily they may be plotted.

Common co-ordinate paper, which is the most familiar, as ordinarily used, is limited to the expression of the relationship between two variables. The relation of three variables may be shown, however, by assigning a constant value to one of the variables and calculating the values of the other two throughout their working-range and thus securing a curve for the one particular value of the one assumed as constant; then assuming a new value for the constant and calculating a new curve, continuing to calculate and plot curves until all of the desired values of the third variable have been treated, Fig. 1. This in effect is the method of isometric plotting, Fig. 2, as used by some engineers, with the exception that rectangular axes are used and the curves on each of the imaginary parallel xz planes, Fig. 2, are projected on to the xz plane through the axis and parallel to the imaginary planes. Practically nothing is sacrificed in clarity of expression by this projection of all curves onto one plane. In fact, the series of curves referred to two axes only, are more easily plotted and read than by the use of three series of reference lines as are characteristic of isometric paper, while the contours of isometric diagrams which are simply constant values of the vertical ordinate become, as would be expected, nothing more than one of the ordinate lines of the group of projected curves. In addition to the confusion attendant upon the three sets of reference lines, isometric paper is limited to the one condition of three variables. That this limitation does not apply to ordinary paper, as might seem to be the case, will be seen later.

In some instances, as the comparison of the expansion curve of an engine, as given by the indicator, with the theoretical curve, the use of ordinary co-ordinate paper is indispensable. However, in almost all cases where paper of equal divisions has been used, paper with logarithmic divisions may be substituted to advantage, as it has a number of valuable properties that greatly simplify the task of plotting a series of results, and it is these particular properties that make it easy to use graphical methods of representing the relationship of more than three variables.

A few of these properties of logarithmic paper may be enumerated as follows: All expressions involving only simple multiplication or division give straight-line curves, and if the expression is of the first degree these lines will be inclined at an angle of 45 deg. up to either the right or the left.

Take for example the familiar expression for moment in a cantilever beam loaded at the end, $M = Pl$. Assuming a constant length of 12 ft. for l , and plotting the values of this expression with M for abscissas and P for ordinates, we get the straight 45 deg. line (a), Fig. 3, in which the inclination is up to the right. This direction of slope occurs in all cases except where the constant is divided by one or other of the variables (abscissas or ordinates).

Taking the same expression as before and assuming a constant M , the expression becomes, $P = M/l$, and when this is plotted with a value of M = say 1,200 ft. lb., we have the 45 deg. straight line inclined upwards to the left, (b) Fig. 3, showing the effect on the direction of inclination, produced by dividing the constant moment by the variable length.

These stated conditions being general in application, regardless of the assumed constant value of the third variable, it follows that when the relationship between three variables of the first degree, involving only multiplication or division, is plotted, a series of parallel 45 deg. lines will result. The reason of

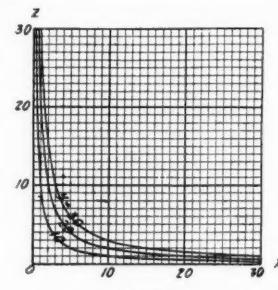


Fig. 1.

this parallelism at 45 deg. is readily seen when it is observed that the origin on logarithmic paper is at infinity, and the increase in values of abscissas and ordinates is always up and to the right. As simple products and dividends (with some limitations) pass through zero (the origin), on ordinary paper, it follows that such lines must take the 45 deg. inclination on logarithmic paper, and we have a graphical representation of the mathematical assumption that parallel lines meet at infinity. This condition of no finite origin, gives rise to another decidedly valuable property, in that the percentage of error does not increase towards the origin as is the case with ordinary paper, but remains constant, thus eliminating the serious objection of inaccuracy at low values which is one of the evils of the ordinary diagram.

As is well known, an expression involving an ordinate or abscissa in any degree but the first, will, when plotted on ordinary coördinate paper, be represented by a curve. With logarithmic paper this is not the case. Expressions of other degrees than the first still give straight-line curves for all simple multiplications or divisions. If either the ordinates or abscissas alone represent a variable that enters in some other degree than the first, the line will make an angle with the axis representing this quantity, the tangent of which will be the same as the index of the power of the quantity.

Consider again the cantilever beam, but with a uniform load per foot of length, we have, then, $M = \omega l^2/2$ in which the length l enters in the second degree.

Assuming a constant load ω of 100 lb. per ft., and plotting with M as ordinates and l as abscissas, we get the straight line (c), Fig. 3, inclined upwards to the right, making an angle with the horizontal axis (representing the second de-

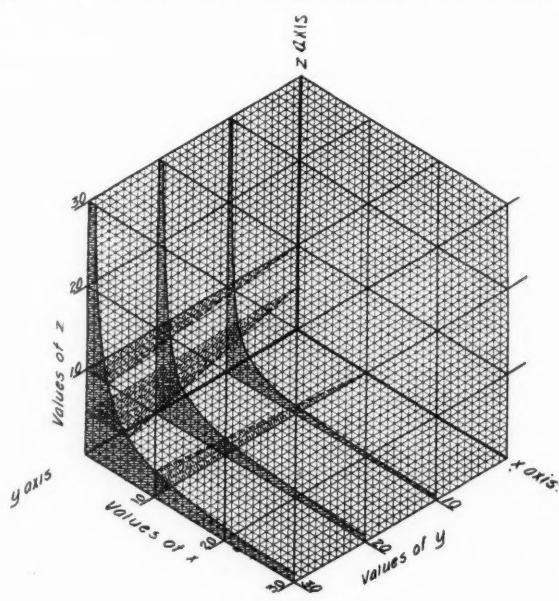
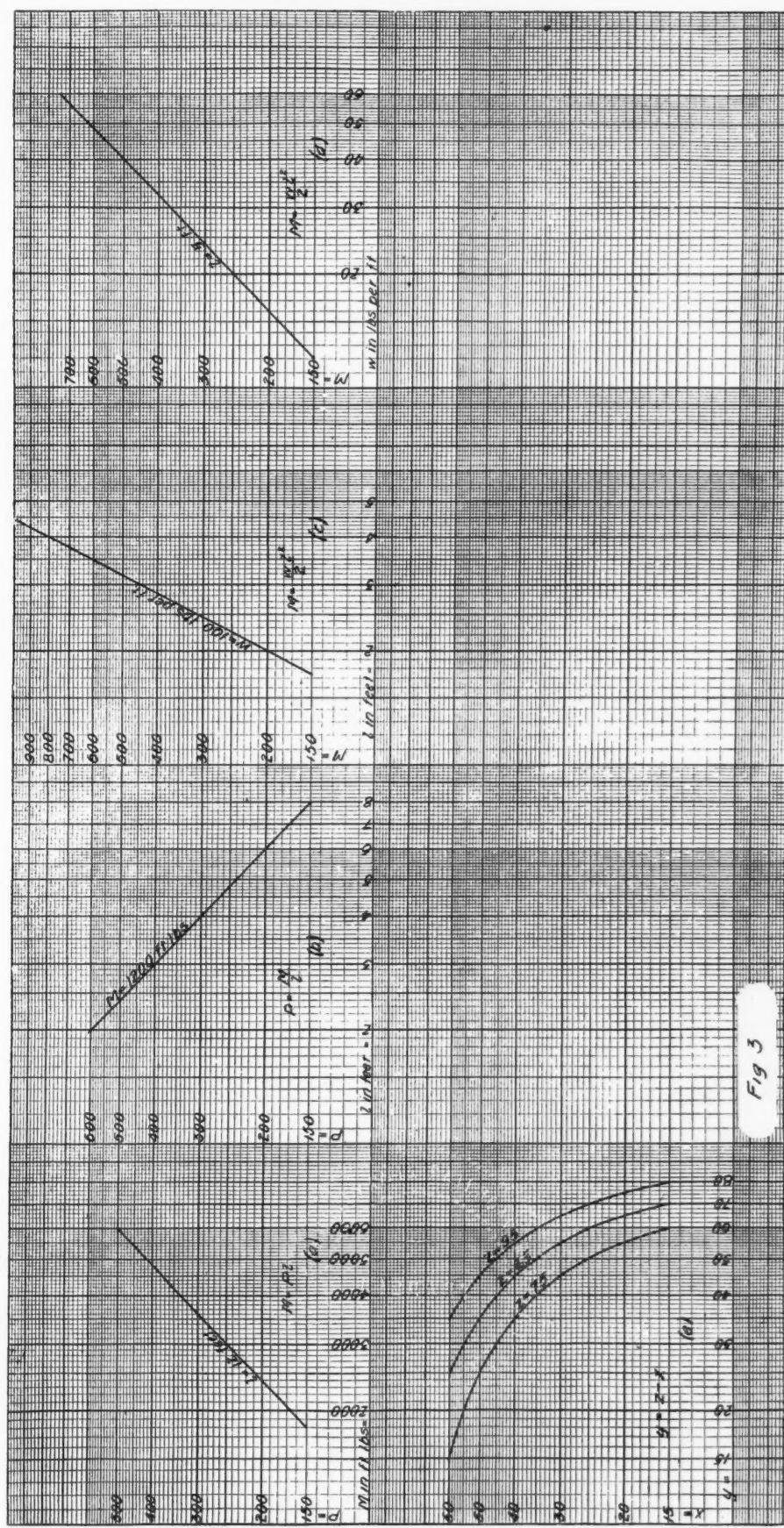


Fig. 2.



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gree of quantity), the tangent of which angle is α , the index of the degree to which the quantity is raised. The direction of slope will always be as explained in (b), Fig. 3, regardless of the degree of any of the variables.

If both the abscissas and the ordinates represent quantities of the same degree, irrespective of whether this is of the first or not, the lines will always be at an angle of 45 deg. no matter what the degree of the third quantity, which is given a constant value for each curve of the set.

Taking the last expression plotted, $M = \omega F/2$, and using M and ω abscissas and ordinates, and plotting their relation for a constant length l of 5 ft. as in (d), Fig. 3, we have the condition of equal degrees for the quantities represented

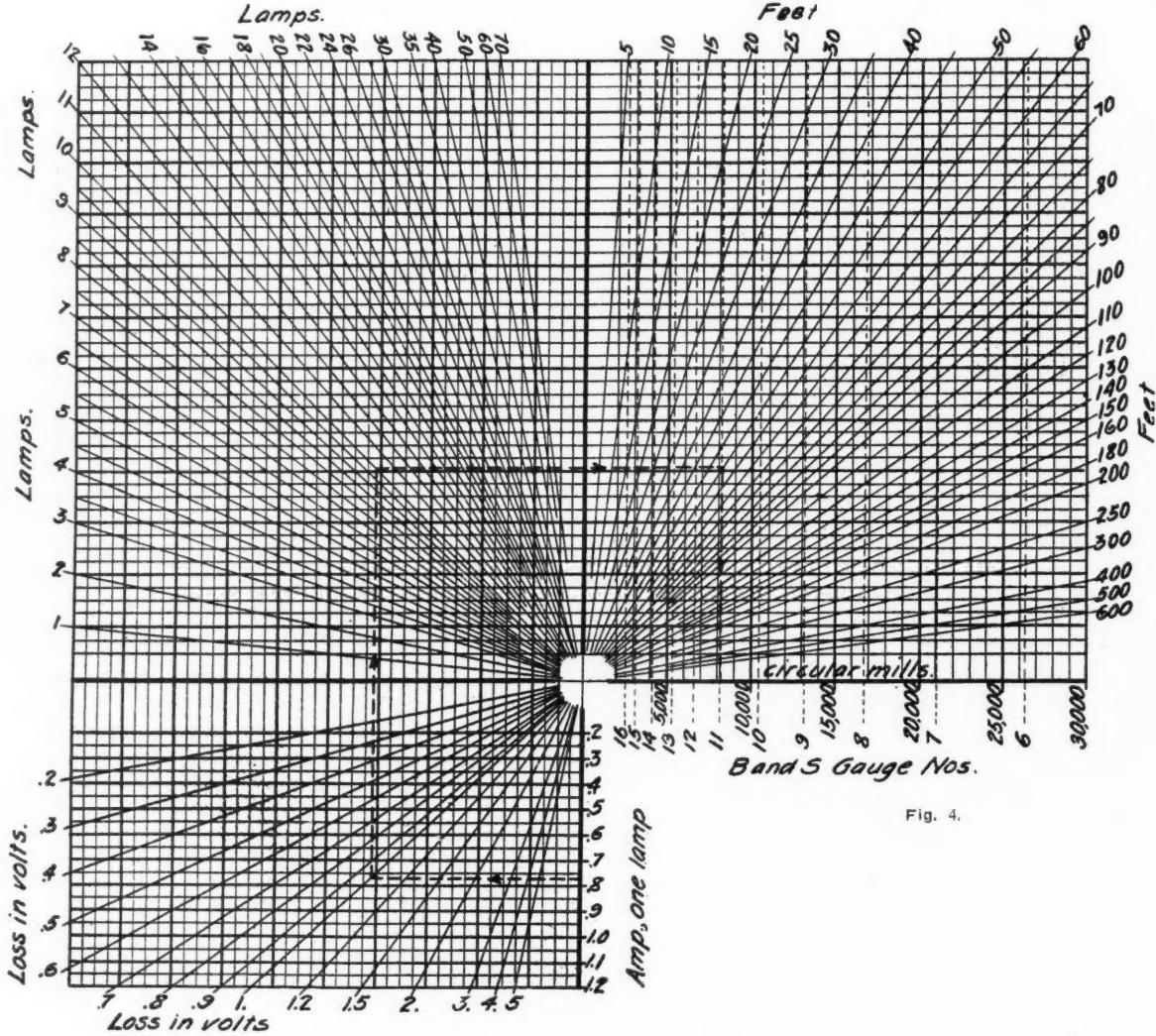


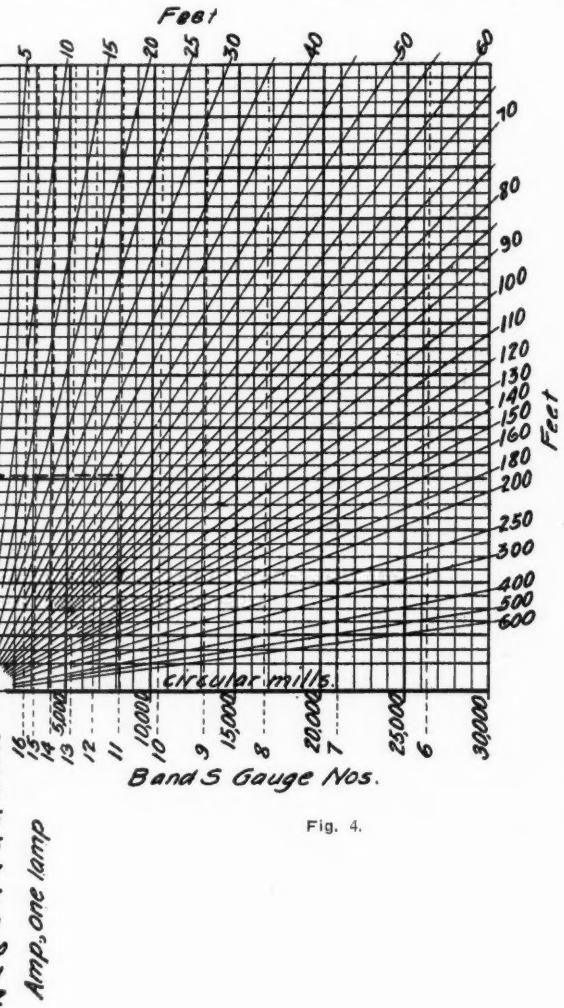
Fig. 4.

by the axes, and obtain the 45 deg. line just as in (a), Fig. 3, where the constant was of the first degree, instead of the second, as is the case here.

These good qualities of logarithmic paper, are accompanied by one of a somewhat negative character, viz., whenever a subtraction or addition enters the expression being plotted, a curved line results. Take the simple algebraic case of $y = z - x$ and plotting with the constant values of 75, 85, and 95 for z , the curves of (c), Fig. 3, results. Strange to say, this is the one condition under which ordinary paper will give a series of parallel straight lines when expressing the relationship between three variables, and even then the quantities used as abscissas and ordinates must be of the first degree.

It is only recently that logarithmic paper with graduations greater than from one to ten has been regularly carried by the supply houses, but now one at least of the better known houses carries paper graduated from one to one-hundred. This inability readily to obtain paper of wider range no doubt accounts, to a considerable degree, for the apparent unfamiliarity of engineers in general with its use, and in particular with its use in connection with the diagrammatical treatment of formulæ involving more than four variables.

As previously stated, any expression of three variables may readily be expressed graphically by assigning a series of constant values to one of them, and calculating a curve



for each of these values. By taking advantage of the 45 deg. parallel, straight line and other properties of logarithmic paper just explained, this task of calculating the curves is reduced to a minimum, as it is usually necessary to calculate but one point on each line—two, if a check on the work is desired—unless additions or subtractions enter the particular relationship being calculated.

As far as the writer has been able to learn, Mr. Edward C. DeWolfe was one of the first to recognize and put to extensive use these valuable properties of logarithmic paper. Others have used it, but at the expense of clearness on account of having plotted two or more sets of lines upon the same space. Some of Mr. DeWolfe's work, as seen recently by the writer, indicates that he used much the same methods

as those to be described later, the principal difference being that in his work, Mr. DeWolfe sometimes follows the diagonal lines, whereas the writer has found it to be easier to make all turns at right angles when reading the diagrams.

Over eighteen years ago Mr. Carl Hering presented a paper before the American Institute of Electrical Engineers, in which he described a method of treating more than three variables graphically, using paper with equal divisions. The diagram presented by him at that time, and reproduced in Fig. 4, gives the solution, as indicated by the dotted line and arrowheads, of all ordinary wiring circuits. The general formula, cross section =

$$\text{Current for one lamp} \times \text{no lamps} \times \text{distance} \times \text{constant,}$$

loss in volts

contains five variables and one constant, all of the first degree. Even with all first-degree variables it is necessary, as Mr. Hering points out, that in plotting any three variables the one assumed as a constant must be a quotient of the other two and not a product, as the latter condition will

formula for thick cylinders has been selected, as it gives one of the simplest applications.

In the formula,

$$\frac{D}{d} = \sqrt{\left(\frac{f+p}{f-p}\right)^{\frac{1}{2}}}$$

D = the outside diameter of the cylinder,

d = the inside diameter,

p = the pressure inside the cylinder,

f = the fiber stress in the metal.

The formula is already in the required form, the fraction D/d being considered as one quantity. We begin then, by calculating the values of the expression under the radical for the various combinations of f and p throughout the range that would be ordinarily met with. This is most readily accomplished by compiling a table as follows, for each one of the values of p that it is desired to have the diagram show. Since this expression contains not only the sum but also the difference of the quantities, it will be necessary to

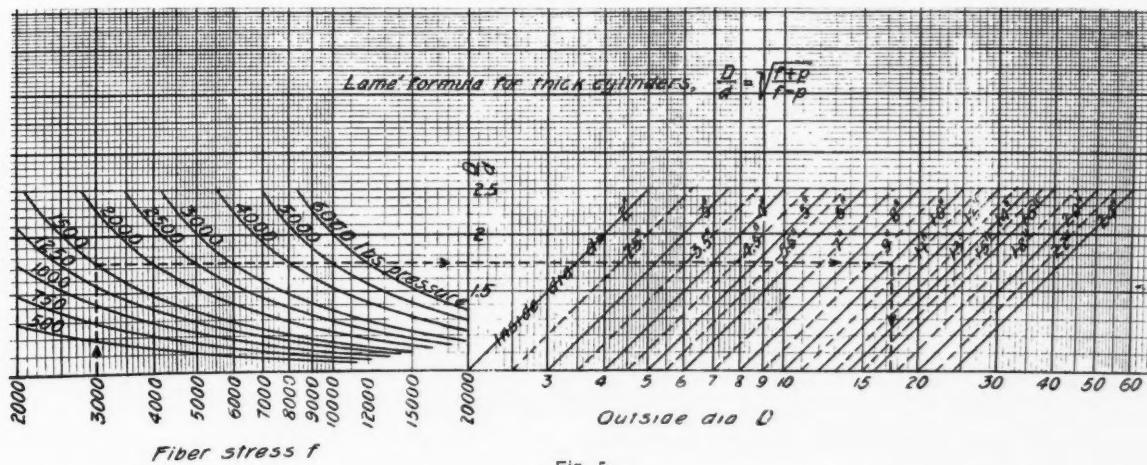


Fig. 5.

result in hyperbolae instead of radial straight lines. As an illustration, consider the simple algebraic expression, $y = zx$.

If x and z be used as ordinates and abscissas, Fig. 2, and constant values of y be plotted, a series of hyperbolae will result, but if the expression be transformed into $x = y/z$, or $z = y/x$, and either expression plotted with the quantity which represents the quotient as a constant and the other two as ordinates and abscissas, a series of straight radial line will result, as evidence the planes of constant zx and xy , Fig. 2, cutting the curved surface of constant yz .

Quite recently there have appeared several diagrams similar to this one of Mr. Hering's, Fig. 4, with one or two more variables added, but plotted with the several sets of lines superimposed on one another, as suggested by him, and having to a decided degree the fault he mentioned, viz., confusion due to the many sets of lines, and also in common with his diagram the element of an increasing percentage of error as the origin is approached.

The principles underlying the construction of diagrams of this class are extremely simple, the solution proceeding by steps as indicated on the diagram just given. The first requirement is that the equation be so transformed that all but two of the variables may be treated as one quantity. Until thoroughly familiar with the method of procedure, it is more convenient to arrange the surplus variables that are to be considered as one quantity on one side of the equation, and the other two on the opposite side.

THICK CYLINDERS.

For the first of a few examples of step solutions, the Lamé

calculate the value of the quantity under the radical, with several values of f , for each value of p , as it has been explained that with logarithmic paper a curve will result whenever sums or differences enter, and for the sake of accuracy the points should not be too widely separated.

p	f											
	2000	2500	3000	4000	5000	6000	8000	10000	12000	16000	25000	30000
500	1.067	1.224	1.224	1.183	1.183	1.151	1.105	1.086	1.064	1.042	1.031	1.021
	$f + p$	3500	4500	5500	6500	8500	10500	12500	16500			
	$f - p$	1500	2000	2500	3500	4500	5500	7500	9500	11500	15500	
	+	1.067	1.224	1.224	1.183	1.183	1.151	1.105	1.086	1.064	1.042	1.031
	$\sqrt{ }$	1.5	1.40	1.285	1.222	1.182	1.133	1.105	1.087	1.064	1.042	1.031

From the above table the first one of the set of p curves of Fig. 5 was plotted, using f as abscissas and D/d as ordinates, while p has the constant value of 500 lb. per sq. in. Curves for other values of p are calculated and plotted in a similar manner.

With the value of D/d determined, a second table is calculated by multiplying these values by a series of constant values of d , which gives the values of D for various relations of d and D/d . As this operation is a simple multiplication without any sum or difference entering, the result of any series of products of D/d multiplied by d will be a 45 deg. straight line inclined upwards to the right, and it will be necessary to use but one value of D/d , as say two (2), with each value of d that it is wished to plot.

The heavy dotted meander line indicates the solution of a problem in which $f = 2,000$, $p = 1,500$, and $d = 10$ in., showing an outside diameter of 17.3 in. required, or a thickness of say $3\frac{1}{8}$ in.

(To be Continued)

The Maintenance of Way Department

Switch Stands.

Editor "Railway Engineering":

I always set switch stands on the closed point side, when possible to do so. The most effective form and color for targets is a red blade about 36 inches long by 10 inches wide in center, tapering down to a point, for siding; for main line a disk, 12 inches in diameter. This is what I would recommend for all main line stands. There are differences of opinion as to the proper height of stand. I prefer a 7-foot stand for main line use.

Indiana.

Supervisor.

Editor "Railway Engineering":

I think switch stands should be placed on the closed point side for safety. Our standard is on engineman's side approaching the switch. Our colors are green and red; a short time ago we changed from white to green. The green switch lamp at night is all right, but I do not like the green target, as it can not be seen until you get close to it. Our green target is the smaller of the two. I am in favor of a large white target, as it can be seen for a long distance.

Indiana.

Roadmaster.

Editor "Railway Engineering":

Switch stands should always be placed on the closed side of a point when it can be done. Also for a facing switch, place on the right hand side with the current of traffic. I think the red and white colors are the best for targets, as they are clearer than other colors.

Illinois.

Roadmaster.

Editor "Railway Engineering":

In my opinion, switch stands should be placed on the closed point side. As to the most effective form and color of target, I think a square switch stand is most effective; and color for main line switch stands, green and red; and inside switch stands, yellow and green.

Roadmaster.

Illinois.

Editor "Railway Engineering":

I see no difference so far as strength is concerned whether switch stands are placed on closed or open side, as you can reverse the automatic switch stands to get the proper position of rod for the closed side, I therefore always place switch stands on engineman's side of track approaching switch. I think this is more important than the position of the lever and that is the only change you make in reversing sides. I consider red the best color for main line targets and green for switches off main line.

Roadmaster.

South Carolina.

Editor "Railway Engineering":

I never heard of the point raised before as to whether switch stands should be placed on the closed or open point side. We always make a practice, where practicable, of placing them on the engineman's side or on the right hand side facing the switch. I never gave much thought to the most effective form and color of targets, but believe that the universal opinion is to have all targets show clear when set for main line, which would, of course, show no color and when thrown for siding to show red, the danger signal; form to be as conspicuous as is deemed consistent and necessary to answer the purpose intended.

Roadmaster.

Montana.

Editor "Railway Engineering":

I think it the best practice to place switch stands on the

turnout or the closed point side. As to the most effective form in color of switch targets, I think the form should be round or oblong and without any sharp points, and a single target only, the color of it being red. That is no target to be shown when switch is lined for main track, and of course the color must be red when set for turnout. I think railroads will eventually adopt this as a standard.

Oklahoma.

Roadmaster.

Personals.

F. W. Gilcreast, formerly division engineer of the Lehigh Valley, at Hazleton, Pa., has been appointed chief engineer of the Lehigh & New England, in charge of the Tamaqua extension, with office at Mauch Chunk.

Charles Kaighn, engineer of the Midland Valley at Muskogee, Okla., has been appointed chief engineer, with office at Muskogee, a new office.

J. E. Schwitzer, assistant chief engineer of the Canadian Pacific, at Winnipeg, Man., has been appointed chief engineer, with office at Montreal, Que.

Charles E. Johnson, division engineer of the Kansas City Southern, at Mena, Ark., has been appointed chief engineer, with office at Kansas City, Mo.

G. E. Bruner has been appointed roadmaster of the new Winston-Salem district of the Atlantic Coast Line and the Winston-Salem Southbound Railway, with office at Florence, S. C.

T. S. Abbott, chief engineer of the Coahuila & Zacatecas at Saltillo, Coahuila, Mex., has resigned.

The office of G. S. Bruce, chief engineer of the Charlotte Harbor & Northern, has been transferred from Arcadia, Fla., to Boca Grande.

E. B. Pleasants, chief engineer, and R. E. Smith, general superintendent of motive power of the Atlantic Coast Line, have had their authority extended over the Winston-Salem Southbound, both with offices at Wilmington, N. C.

M. H. Elkin, division engineer of the Lehigh Valley, at Auburn, N. Y., has been transferred to Hazleton, Pa., succeeding F. W. Gilcreast, resigned to go to another company. R. L. Gebhardt succeeds Mr. Elkin, with office at Auburn.

Francis Lee Stuart, chief engineer of the Erie, has been appointed chief engineer of the Baltimore & Ohio, and the Baltimore & Ohio Southwestern, with office at Baltimore, Md., succeeding A. W. Thompson, promoted to general manager. Mr. Stuart was born Dec. 3, 1866, at Camden, S. C., and graduated from Emerson Institute, Washington, D. C., June, 1884. He began railway work in 1884 as a rodman under James L. Randolph, chief engineer of the Baltimore & Ohio, and was afterwards consecutively, levelman, transitman and resident engineer until 1887, when he went to Alabama as engineer for the Cahaba Coal Mining Co., locating railways, building coking plants and opening mines. From 1889 to 1891 he was resident engineer in charge of the heavy construction work of the Briafield, Blockton & Birmingham, and later was engineer of maintenance of way on the same road. From 1891 to 1892 he was engaged in various engineering work near Birmingham, Ala., and then returned to the B. & O. as resident engineer in charge of the construction of 20 miles of the line between Uniontown, Pa., and Morgantown, W. Va., and construction work in the Connellsville region. He was later supervisor in charge of the line from Connellsville to Fairmont. From the spring of 1895 to 1897 he was engineer and contractor on various new railways, and was then appointed assistant engineer on the Nicaragua Canal Commission, in charge of the topographical and hydrographic survey of the San Juan river, from Lake Nicaragua to the sea. After the commission returned to the



F. L. Stuart.

United States he was left in charge and made the hydrographic survey of Lake Nicaragua, returning to the United States in 1898. He was in charge of the estimates of cost of the various canal variants in Nicaragua, and was held over until the Isthmian Canal Commission was formed. As division engineer he preceded the commission to Nicaragua and prepared the organization. He resigned during the winter of 1899, and again returned to the B. & O., being made assistant engineer on location and construction. His jurisdiction was gradually extended until January, 1903, when he was appointed district engineer, in charge of development of low grade trunk line improvements for the betterment of the B. & O. in Maryland, Pennsylvania and Ohio. In 1904 he was transferred to Baltimore as engineer of surveys of the entire system, resigning this position in March, 1905, to become chief engineer of the Erie Railroad, which position he now leaves to become chief engineer of the B. & O. Mr. Stuart is a resourceful engineer. He is progressive and thorough, and while with the Erie Railroad he carried out to successful completion work on the four-track tunnel and open cut through Bergen Hill at Jersey City, N. J. He also mastered the problem of putting in foundations for a trestle over a swamp on the summit between the Allegheny and Genesee rivers, into which construction piles had been driven 117 feet without reaching a foundation which would support the trestles. When the wrecking of the swing span of the drawbridge at Cleveland, O., put the crossing out of commission, he took 95-ft. girders into the shop, braced them together, added counterweights, and, mounting the structure on an old turntable center with a pile foundation, made it possible to resume traffic within a short time, the improvised draw swinging through an angle of 90 degrees to permit vessels to go on their way. He is a director of the American Society of Civil Engineers and of the American Railway, Engineering and Maintenance of Way Association.

Reorganization on the Rock Island.

For operating purposes and to secure closer supervision and more efficient management, the lines of the Rock Island have been divided into three districts, to be known as the first, second and third, each to be under the jurisdiction of a general manager and co-ordinate officers in the traffic department. The plan became effective February 1, 1911.

The following from a recently issued bulletin describes the territory embraced in the three districts, and announces the general managers in charge of each:

First district—All the mileage east of the Missouri river, and also the mileage from St. Joseph, Mo., to Horton, Kan., in charge of W. S. Tinsman, general manager, headquarters at Chicago, Ill.

Second district—All the mileage west of the Missouri river, and north of Caldwell, Kan., including the St. Louis division, in charge of A. E. Sweet, who is appointed general manager, with headquarters at Topeka, Kan.

Third district—All the mileage south of Caldwell, Kan., and east of Tucumcari, N. Mex., in charge of W. M. Whittenon, general manager, headquarters at Ft. Worth, Tex.

Subject to later orders, the following officers will report to the second vice-president:

The three general managers.

Chief engineer.

General superintendent of motive power.

Engineer of tests.

Superintendent of car service.

Assistants to second vice-president.

The jurisdiction and headquarters of general superintendents is as follows:

C. W. Jones, general superintendent, with headquarters at Davenport, first district.

J. B. Smalley, general superintendent, with headquarters at Topeka, Kan., second district.

T. H. eBacom, general superintendent, with headquarters at El Reno, third district.

T. H. Beaicom, general superintendent of the Northern district is abolished.

A. C. Ridgway, former assistant general manager, and C. H. Hubbell, former general superintendent of the Northern district, are to be attached to the office of the second vice-president.

W. J. Tollerton is assistant general superintendent of motive power for the system.

J. B. Kilpatrick is appointed superintendent of motive power of the First district.

S. W. Mullinix is appointed superintendent of motive power of the Second district, with headquarters at Topeka.

C. M. Taylor is appointed superintendent of motive power of the Third district.

The Northern district having been abolished, F. W. Williams is appointed master mechanic with jurisdiction over the Cedar Rapids, Dakota and Minnesota divisions.

The officers of all district engineers have been abolished.

The following engineers maintenance of way have been appointed:

First district, W. H. Peterson, headquarters at Rock Island, Ill.

Second district, J. M. Brown, headquarters at Topeka, Kan.

Third district, A. B. Warner, headquarters at El Reno, Okla.

F. J. Easley, superintendent of the Missouri division, has been transferred to the Illinois division.

H. L. Reed, superintendent of the El Paso division, has been transferred to the Missouri division.

H. P. Greenough, superintendent of the Illinois division, has been transferred to the El Paso division.

C. L. Rupert, trainmaster, has been promoted to be superintendent of the Amarillo division, vice H. E. Allen, resigned, to accept service with the T. & B. V. as superintendent at Teague, Tex.

Garrett Davis, superintendent of the St. Louis division, has been transferred to the Louisiana division.

M. J. Kennelly, superintendent of the Louisiana division, has been transferred to the St. Louis division.

The district stores at Silvis, Horton and Shawnee are assigned to the First, Second and Third districts, respectively, reporting to the general managers on distribution of material.

February, 1911.

The titles of district storekeepers at Chicago and Cedar Rapids are changed to storekeepers.

The district storekeepers and storekeepers will continue to report to the general storekeeper on matters of stock and interchange of materials as between districts.

To conform to the division of the lines into three districts the passenger department announces that the jurisdiction of general passenger agents over line territory will be as follows:

The First district will embrace all territory east of the Missouri river (including Missouri river points on all eastbound business), and will be in charge of W. J. Leahy, general passenger agent with headquarters at Chicago.

The Second district will embrace all territory west of the Missouri river (including Missouri river points on west bound traffic), and north of Caldwell, Kansas and also St. Louis division (except the city of St. Louis) to be in charge of J. A. Stewart, who has been appointed general passenger agent, with headquarters at Topeka, Kan.

The Third district will include all territory south of Caldwell, Kan., and east of Tucumcari, N. Mex., and the city of St. Louis, Mo., to be in charge of George H. Lee, general passenger agent, with headquarters at St. Louis, Mo.

Phil A. Auer has been appointed general passenger agent, with headquarters at Chicago, coming to Chicago from Fort Worth, Tex.

G. S. Pentecost, formerly assistant general passenger agent at Kansas City, has been appointed general passenger agent of the Chicago, Rock Island & Gulf, with headquarters at Fort Worth, Tex., vice Phil A. Auer.

To conform to division of these lines into three operating districts, the jurisdiction of general freight traffic officers named below, over line territory, will be as follows:

First district—All territory east of the Missouri river (not including Missouri river points and the St. Louis division), in charge of H. A. Snyder, general freight agent, headquarters, Chicago, Ill.

Second district—All territory on and west of the Missouri river and north of, including Caldwell, Kan., east of Texoma, Tex.; the St. Louis division and El Paso division in New Mexico, in charge of F. J. Shubert, general freight agent, headquarters Kansas City, Mo.

Third district—All territory south of Caldwell, Kan., and east of Texoma, Tex., in charge of H. W. Morrison, assistant freight traffic manager, headquarters Little Rock, Ark.

Two circulars issued by the freight department earlier in the month read as follows:

F. J. Shubert has been appointed general freight agent, with headquarters at Kansas City, Mo., vice R. G. Brown, transferred.

R. G. Brown has been appointed assistant general freight agent, with headquarters at Minneapolis, Minn.

George B. Heatherington, formerly chief clerk to general superintendent J. B. Smalley, has been appointed chief clerk to general manager A. E. Sweet.

C. G. Adams, formerly chief clerk in the office of division superintendent at Rock Island, has been appointed chief clerk to general superintendent J. B. Smalley.

H. C. Mulroy, formerly in the office of the second vice-president, is attached to the staff of the general manager at Topeka.

Paul Hevener has been appointed assistant supervisor of insurance fund, with office at Chicago.

CONSTRUCTION.

The Cincinnati, Hamilton & Dayton has finished its new yard at Toledo. It has capacity for 3,000 cars, as follows: Receiving, 800 cars; classification, 850; holding, 350; storage,

250; outbound, 350; repair, 150; and caboose, 50. The yards have gravity tracks and are about four miles long.

The Mexico, Farwell & Southern has awarded a contract to the Calback Construction Co., Portland, Ore., to build about 100 miles of new line from Texico, N. M., and Farwell south.

A contract has been awarded to Bunn & Co., Big Stone Gap, Va., for the construction of five miles of railroad up Roaring Fork, from a point near Appalachia, Va., on the Interstate railroad.

Work on the Brinson railroad, which is being constructed from Savannah to Athens, Ga., is progressing rapidly. A large force is engaged in grading and laying ties at Waynesboro, in Burke county, a hundred miles this side of Savannah. The road will come by Thomson, Washington and Lexington.

The Copper River & Northwestern will resume construction on the extension through the Tanana district toward Fairbanks, Alaska, on March 1, the first contract covering the lines to Kennecott. The northern construction will begin at Chitina, 150 miles from the ocean terminal at Cordova, and be pushed toward Fairbanks, a distance of 300 miles. The extension will cost around \$30,000,000 and will be the largest project ever undertaken in the territory.

The contract for the construction of thirty miles of railroad, connecting the Santa Fe at Longview with the iron fields of Cass county, has been let to the C. H. Sharp Construction Co., of Kansas City.

The Norfolk & Western has awarded contracts for the construction of 11½ miles of track to be known as the Cedar Bluff extension. Rinehart & Dennis Co., Washington, D. C., two miles; Walton & Co., Falls Mills, Va., two and one-half miles; W. O. Lipscomb, Roanoke, Va., two miles; A. H. Valz, Staunton, Va., two miles; P. J. Millett, Paris, Ky., two and three-quarter miles. Another extension, known as the North Fork branch, to consist of four miles, was awarded as follows: Vaughan Construction Co., Roanoke, two miles; Carpenter & Boxley, Roanoke, two miles. The cost will be about \$1,500,000, and work will be started at once on all the contracts.

The Callahan Construction Company, railroad contractors and builders, of Knoxville, Tenn., have been awarded sixteen miles of work on the Lexington & Eastern, extending out from Jackson, Ky., in the southeastern portion of the state. The work is located near Whitesburg, Ky., and consists of much fine mountain rock, some dam work, stone box culverts and concrete work. Contractors who would be interested in any of this class of work should communicate with the general superintendent of the company, E. R. Keller, care of home office.

The Santa Fe has awarded a contract to Geo. West for improvement work to consist of widening the roadbed on the valley division between Bakersfield and Latou, Cal., eighty-six miles. The work includes placing 3,000 yards of dirt to each mile to bring the roadbed up to grade and laying heavy rails.

The contract for the construction of the Port Bolivar Iron Ore Railway from Longview, Texas, to the Cass county iron ore fields, 30 miles, has been let to C. P. Sharp. It is a Santa Fe project.

The Rio Grande Railroad, which runs between Brownsville, Texas, and Point Isabel, 22 miles, is to be rebuilt.

The Denver, Enid & Gulf, which stopped construction work last summer, will begin building again and will push from Texoma southward toward Dallas and northward towards Lamar, Colorado, which city has given a bonus of \$100,000 to secure the line.

The M. O. & G. has made its permanent survey from Coalton to Okmulgee and the city of Okmulgee is preparing

to vote \$25,000 of bonds towards improvements that will make the building much easier.

The Wichita Falls & Northwestern is building from Altus to Hollis and may also build into Oklahoma City.

Early in the spring the Denver & Rio Grande will begin double-tracking its line from Denver to Salt Lake. In the meantime, engineers are engaged in making surveys.

The Louisville & Nashville has awarded a contract to the Thrasher & Gunther Construction Co., Knoxville, Tenn., for double tracking through the 750 foot tunnel between Covington and Latonia, Ky.

The Lehigh & New England has awarded a contract to McArthur Brothers, 11 Pine street, New York, and 227 Dearborn street, Chicago, at \$3,000,000, for building the extension from Danielsville to Tamaqua, 32 miles long. It will cross the Blue Ridge over easy grades to Lehigh Gap, where a river bridge, to cost \$1,000,000, will be built across the Lehigh, 110 feet above the water. Thence the line will extend through the Lizard creek and Mahoning valleys to the collieries of the Lehigh Coal & Navigation Co., in the Tamaqua region.

The St. Louis, Bartlesville & Pacific has awarded a contract to the Oklahoma Western Construction Co. for the construction of 225 miles of road from Joplin, Mo., to Carmen, Okla.

The Cherryvale & Oklahoma & Texas has awarded a contract for building 145 miles of road, a main line of 50 miles from Caney, Kan., to Pawhuska, Okla., and a branch line of 65 miles from Vinta, Okla., to Siloam Springs, Ark., to the Continental Construction Co.

J. A. Kelley & Co., contractors in charge of the extension of the four track system of the Lehigh Valley, will begin the work soon. The extension will connect Bethlehem to Mauch Chunk, Pa.

Mason & Hanger Co., Richmond, Ky., has let a sub-contract for work on the second track for the Queen & Crescent, from Oakdale to Lansing, Tenn., to the Gibson-Carr Co., Middlesboro, Ky. The work follows Emery river a distance of 15 miles, and includes 642,500 cubic yards of rock excavation.

Mayor E. W. Brown, of Orange, Tex., who has the original contract for building the Orange-Vinton road through the Sabine river marsh in Louisiana, has sublet a contract to Dr. A. C. Wilkins and he is arranging to have a dredge brought from Leesburg, La., and begin construction work at once.

The Temple Northwestern has awarded a contract for about 40 miles of grading to D. G. Grigsby, Dallas, Tex. Right of way has been obtained for 100 miles and surveys for the entire route, 150 miles, have also been completed.

Robert A. Lysle & Co., First National Bank building, Chicago, Ill., has been awarded a contract by the Nueces River Valley Railroad for the construction of 233 miles of road from Aransas Pass to Eagle Pass, Tex., via Oakville and Catula.

The C. H. Sharp Contracting Co., Kansas City, has awarded a sub-contract to Sweeney & Alley for work on the Port Bolivar Iron Ore Railway.

The Colorado & Southern has started construction on the line from Cheyenne to Wellington, Colo. Kilpatrick Bros., Beatrice, Neb., general contractors, have awarded sub-contract for grading a stretch near Warren Valley ranch to H. E. Owen.

The Colorado & Southern has awarded contracts to Kilpatrick & Terrell, Denver, Colo., for the construction of a railroad to run from Wellington, Colo., to Cheyenne, Wyo., a distance of about 35 miles, to cost about \$1,500,000.

The Interstate Railroad has awarded a contract to Bunn

& Co., Big Stone Gap, Va., for building a 5-mile extension on its Roaring Fork branch.

The Lexington & Eastern has awarded a contract to the Callahan Construction Co., Knoxville, Tenn., for sixteen miles of work on their road, extending from Jackson, Ky., in the southeastern portion of the state. The work is located near Whitesburg, Ky., and consists of very fine mountain rock work, team work, stone box culverts and concrete work.

The Chesapeake & Ohio has awarded contracts to build bridges and to grade for the double tracking between Lawrence Creek and Foster on its line, to Will Ireland, Maysville, Ky.

The Louisville & Nashville has awarded a contract for a double track through 750 feet of tunnel between Covington and Latonia, Ky., to the Thrasher & Gunter Construction Co., Knoxville, Tenn.

A contract has been let to the Oklahoma-Western Construction Co., which is to build a new line from Joplin through Bartlesville to Carmen, a distance of 261 miles.

The Queen & Crescent has awarded a contract to Mason & Hanger Co., Richmond, Ky., for constructing a second main track from Oakdale to Lansing, Tenn., a distance of twelve miles.

The Port Bolivar Iron Ore Ry. has awarded contracts to the C. H. Sharp Construction Co., Kansas City, Mo., for the latest addition of the Texas Railroad. The firm has contracted for clearing the right of way, doing all grading, building all bridges, laying the rails and surfacing the track of the new line. Construction will start from the Longview terminus where the new line connects with the Gulf, Colorado & Santa Fe.

The Rock Island, Texico-Farwell & Gulf has awarded a contract for building 30 miles of road between Farwell and Center, Tex., to M. F. Calback & Co. This road is a part of the proposed road 285 miles in length from Pyote to a connection with the Chicago, Rock Island & Pacific, near Tucumcari, N. M. Work will be started at once.

The contract was awarded to McDowell & Co., Knoxville, Tenn., for the construction of a new road from Harriman to Oliver Springs, a distance of about 17½ miles, at a cost of about \$500,000. The Louisville & Nashville is interested.

J. R. McDowell, who was awarded the contract for 17½ miles of construction on the Harriman, Knoxville & Eastern, has awarded sub-contracts to the F. W. Hunt Contracting Co., and the Cross Construction Co., A. G. F. Fretwell, M. M. Schultz, George L. Davidson and Eddington & Pack.

The Lexington & Eastern has awarded a contract to Winston & Co., Richmond, Va., for extending its road 12 miles from a point three miles above Whitesburg, Ky., to and up Boone's Fork. This makes the extension from Jackson, Ky., 100 miles long.

Kaiser & Maloney, railroad contractors, now at Stuttgart, Ark., have finished ten miles of the Central Arkansas & Eastern. They are now ready to take a new contract requiring machine work.

Good progress is being made by the Canadian Northern on a new road between Virginia and Duluth. Contractor Jacobson has the eleventh part of the work well along. Night and day crews are being worked by several of the sub-contractors, and every effort made to push the work to a rapid completion.

The Somerset Construction Co., concrete contractors on the Western Maryland, have completed the abutment south of the Casselman river, near Salisbury Junction, and have commenced work on the abutments north of the B. & O. railroad track. The bridge will be 1,900 feet long and unless the weather proves very unfavorable, work will continue uninterrupted all winter.

The Signal Department

RAILWAY SIGNAL STANDARDS NO. 15. THE LEHIGH VALLEY.

This road uses normal danger automatic block signals exclusively. Heretofore most of the signals were of the enclosed disk type, see Fig. 358 for disk instrument, removed from case. More recently semaphores have been supplanting the disks. Until very recently lower quadrant, 60 deg. two position semaphores, Fig. 359, were standard, but lately some three position upper quadrant semaphore signals have been installed. Semaphores are operated by carbonic acid gas, controlled electrically and by electric motors. Night color indications are white for clear, green for caution, red for stop. Mechanisms are housed at the base of the post.

Current for operation is supplied by potash or gravity battery, the latter only occasionally for disks. From 16 to 18 cells of potash battery are used for a semaphore, and from 10 to 24 cells for disk signals. The battery is housed in a case at the base of the signal, or in a wooden, concrete or iron well. The same battery is used to operate a signal and control line circuits.

Track circuits are fed from two cells of gravity battery in multiple, housed in an iron chute or in the well with the other battery. Track circuits are usually 3,500 ft. long.

Overlaps and automatic stops are not used. Line wires are strung on the same poles as the telegraph wires. Common return is broken every 8 to 20 miles. Wires are arranged on the cross arms in the order shown in the circuit plans. Wire ducts consist of wooden trunking, Fig. 360, run below ground.

Switch indicators are provided for all switches. They are of the disappearing disk type, Fig. 361. Fig. 362 shows one type of bracket post used. Lattice posts are also employed.

No cable posts are used. A cross arm is attached to the line pole nearest a signal, parallel to the track, and wires run directly from this to a corresponding arm on the signal.

Typical circuit plans for automatic block signals, switch indicators, semi-automatic signals, electric locking and other accessories are shown herewith.

Relays are of the glass enclosed type, and for track circuits are of 4 or 16 ohms resistance.

The following sizes and classes of wire are standard: For line, No. 10 and No. 12, B & S. gage, hard drawn copper; for bootlegs, No. 8 B. W. G., E. B. B., double galvanized iron wire; for leads from track, No. 12, B. & S. gage, rubber covered copper; for leads from line and from battery, No. 14, B. & S. gage rubber covered copper; in chutes, No. 12, B. & S. gage, rubber covered flexible copper.

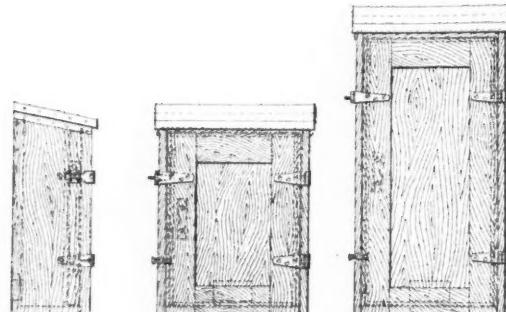


Fig. 364. Wooden Relay Boxes.

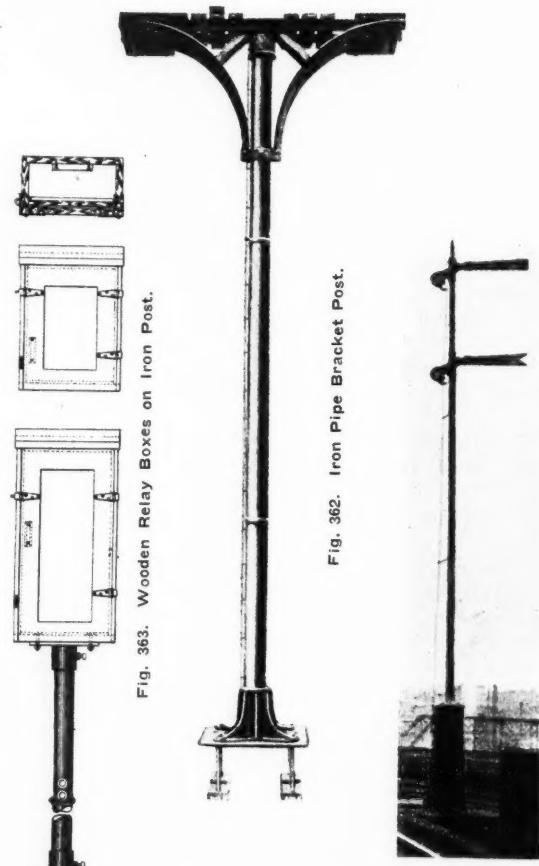


Fig. 362. Iron Pipe Bracket Post.

Fig. 363. Wooden Relay Boxes on Iron Post.



Fig. 359. Double Arm Two-Position Lower Quadrant, Automatic Block Signal—Lehigh Valley.

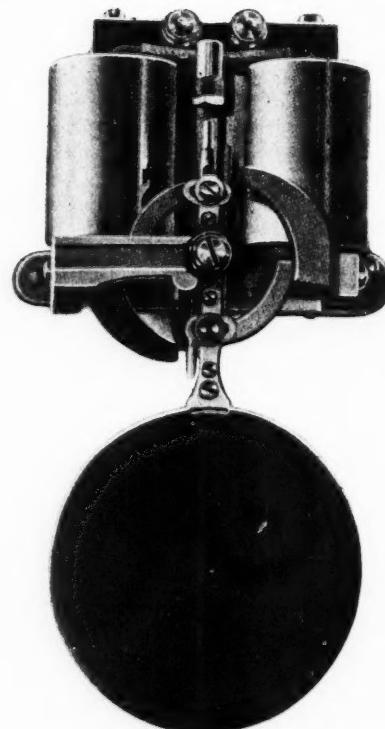


Fig. 358. Disk Signal Instrument.



Fig. 361. Disk Indicator Head.

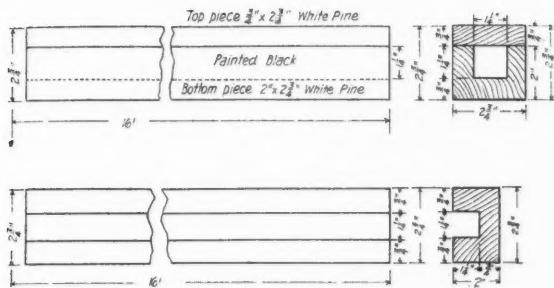


Fig. 360. Trunking and Capping, Lehigh Valley.

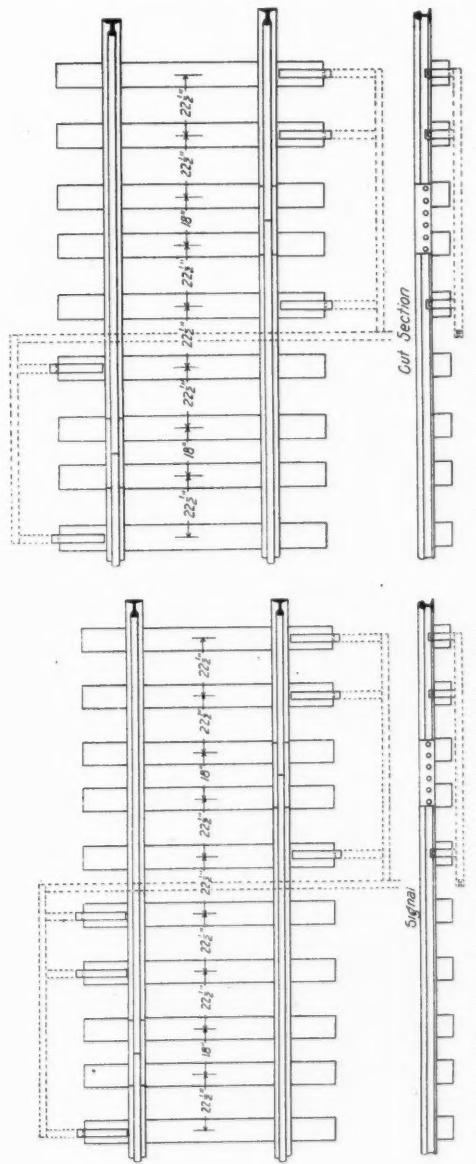
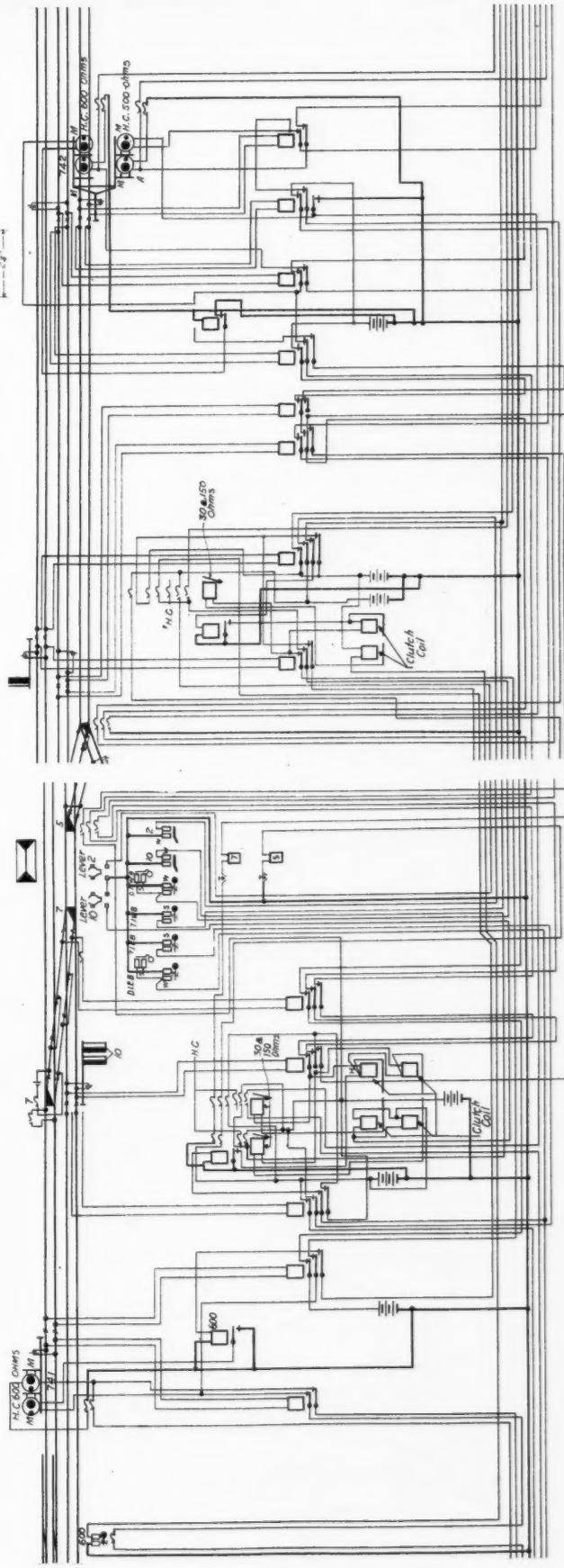


Fig. 365. Trunking Layout at Cut Section, Lehigh Valley.

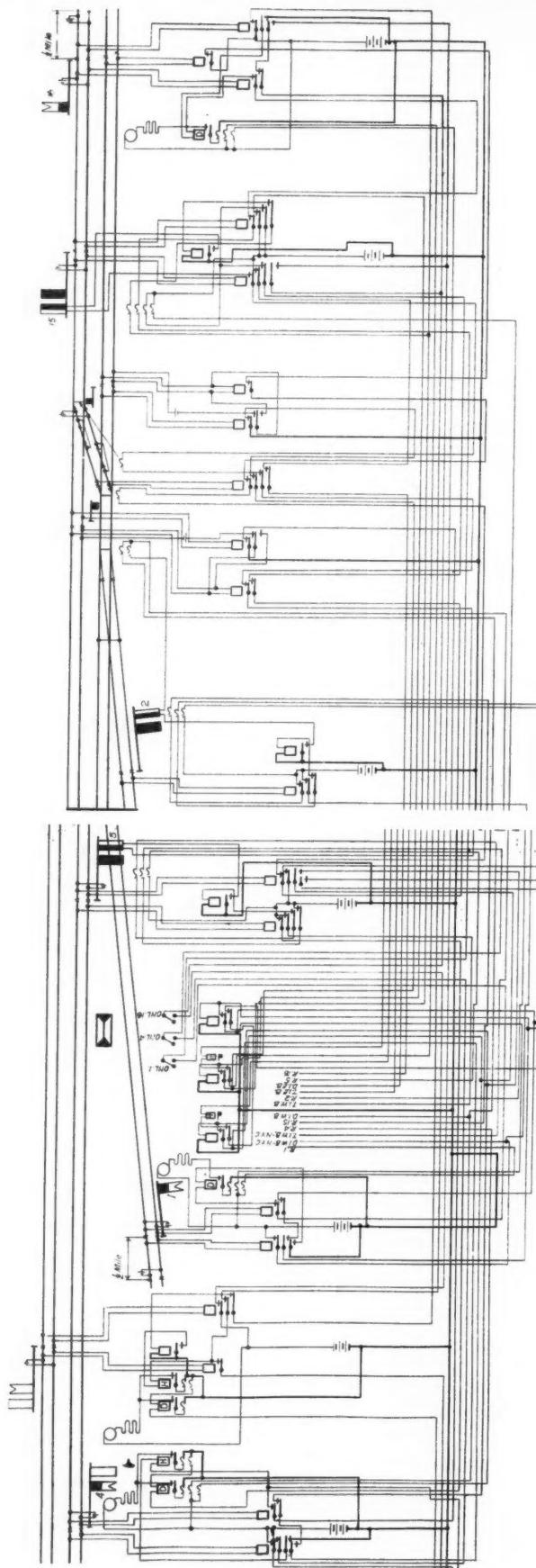
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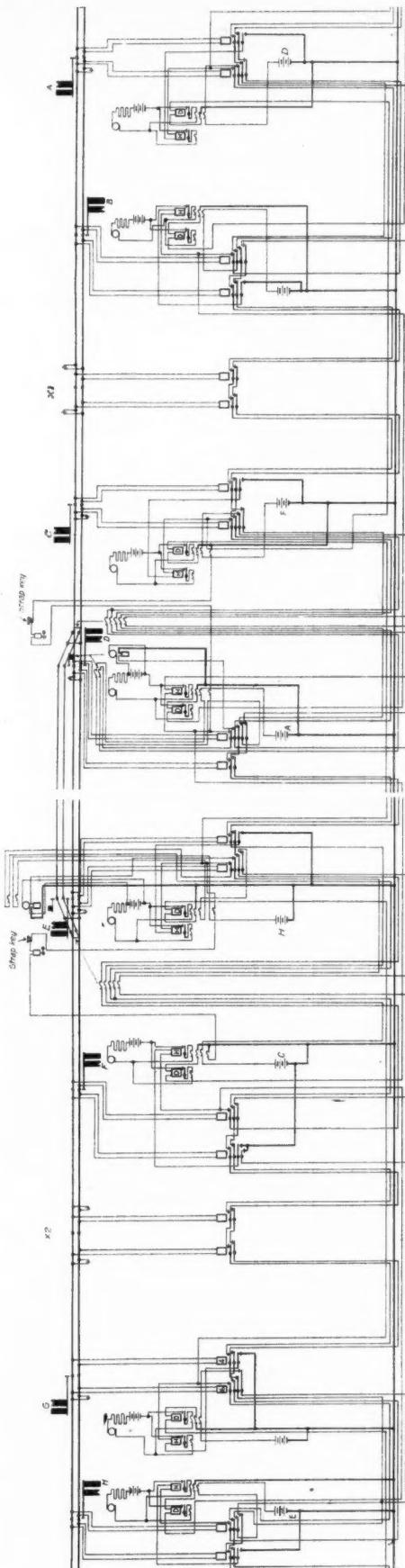
FIGS. 367-368. Typical Electric Locking and Semi-Automatic Block Signal Circuits, Lehigh Valley.

**RAILWAY
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Figs. 369-370. Typical Electric Locking and Semi-Automatic Block Signal Circuits, Lehigh Valley.



Figs. 371-372. Typical Single Track Automatic Block Signal Circuits, Lehigh Valley.

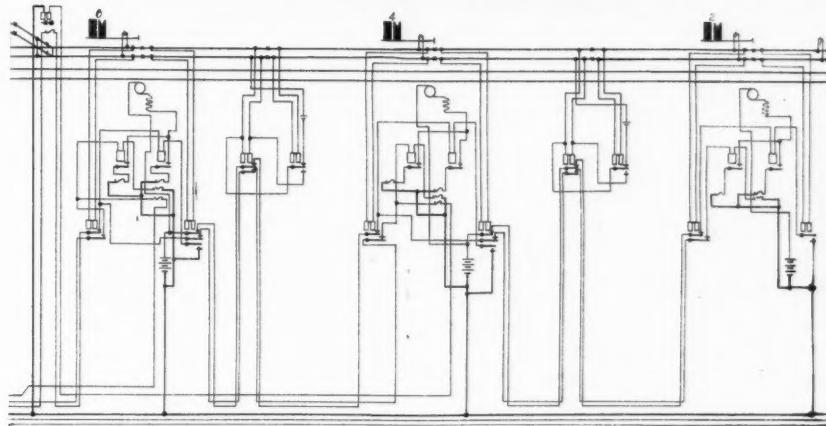


Fig. 373. Typical Double Track Automatic Block Signal Circuits, Lehigh Valley.

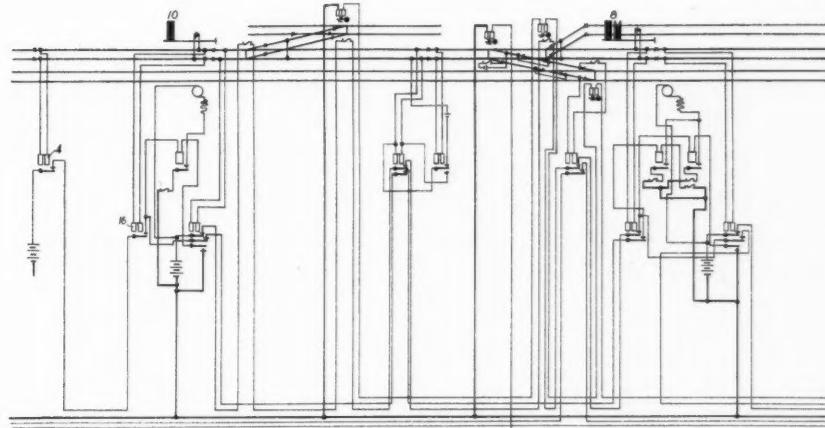


Fig. 374. Continuation of Fig. 373.

The Louisville & Nashville has growing, on tracts of land along its lines, about 2,000,000 catalpa trees, many of them on grounds surrounding the homes of track foremen, where they are valuable for shade.

The train shed of the Nashville, Chattanooga & St. Louis, at Chattanooga, Tenn., was destroyed by fire on the morning of Jan. 10, together with a train of passenger cars. The historic locomotive, "General," which stands in this station, was saved from the flames.

A bill has been introduced in Congress by Senator Jones, of Washington, to require railways doing interstate business to adopt uniform operating rules. The purpose seems to be to make compulsory, through governmental intervention, the rules of the American Railway Association.

The Oregon Railroad & Navigation Co. will install 55 miles of single-track automatic block signals during 1911, and will rearrange the signaling on 14 miles of single track for double track working.

The Boston & Maine is planning to complete the installation of automatic block signals on 423 miles during 1911. The work is already half completed on nearly 80 per cent of this distance.

The reductions in sleeping car rates, which have been under consideration for several months, have been announced by the Pullman Company to go into effect February 1. The tariffs filed provide that where the lower berth rate is \$1.50 the upper berths will be \$1.25, and where the lower berth

rate is more than \$1.50 the upper berths will be 20 per cent less. The minimum rate for lower berths will be \$1.50, and that of upper berths \$1.25.

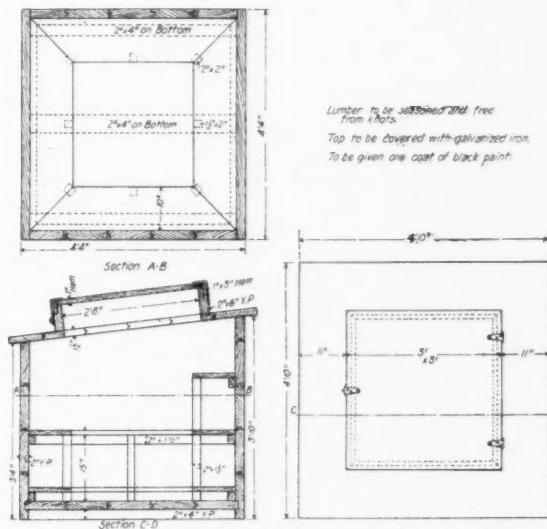


Fig. 375. Wooden Battery Well, Lehigh Valley.

ELECTRIC SIGNALING FOR ELECTRIC RAIL-ROADS.*

(Continued)

Alternating Current Track Circuits Used With Alternating Current Propulsion.

Track circuits of this type must necessarily embody the fundamental principles of all alternating current track circuits and also embrace certain characteristics, i. e., the track circuits must be of the two-rail type; both lines of rails forming both sides of the track circuit must be of the same impedance in order perfectly to balance the propulsion current; the track relays must be inoperative if any of the propulsion current due to the unbalancing of the track circuits should pass through them or the track transformer; the frequency of the track circuit must be different from the propulsion current, and is usually higher, the usual practice being 60 cycles with 25 cycles or lower for propulsion. At the present time there are two systems of track circuits in use with alternating current propulsion—first, where a single phase frequency relay is used, and second, where a polyphase relay is used.

be absolutely inoperative at any frequency which may be used for propulsion purposes.

Track Circuits—Polyphase Relays.

Another type of track circuit with which a polyphase relay is used differs considerably from the single-phase arrangement. Polyphase relays are inoperative unless a proper phase relation of the same frequency is established between the windings, hence, it will be seen that should a current of an abnormal frequency enter one winding with a normal frequency in the other winding, the contacts would open, providing the foreign current was of sufficient strength to create a sine wave greater than the sine wave of the normal current. Such a current would in all probability burn out the relay windings and open its contacts; therefore, a polyphase relay may be used for track circuit purposes upon a track carrying an a. c. propulsion current, provided that provision is made to prevent the propulsion current from entering both the windings of the track relay. This may be accomplished by two power lines feeding the track relays, these two lines to be fed by two separate single-phase a. c. generators mechanically connected together in such manner

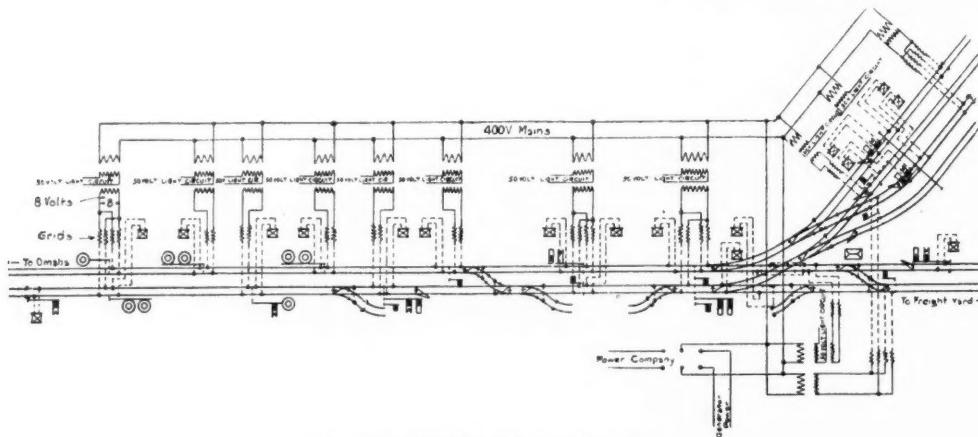


Fig. 23. Council Bluffs, Ia.—U. P. R. R.

Track Circuits—Single Phase.

A track transformer is used with the primary connected to the main transmission leads and the secondary to the rails at the center of the track circuit. At each end of the track circuit a single-phase frequency relay is connected to the rails, and also an impedance bond is connected between the rails, the center of this bond being provided with a connection designed to carry the propulsion current to the next track circuit connecting with the center connection of a similar bond. In usual practice track circuits of less than 1,900 feet require but one relay, the transformer being connected at the end of the circuit in a similar manner to the usual method of connecting track batteries. The transformer used in this arrangement may be of any type to give the proper voltage and amperage for supplying the necessary energy to the rails. There are in use in general two types, one equipped with an adjustable filler or laminated iron hanger suspended between the coils of the transformer for adjusting the voltage to the track, being arranged also as a break-down or no voltage on the secondary coils when they are short circuited, as by a train on the track. The other type of transformer may be built according to modern commercial practice, delivering the proper current to the track, but in connection with this there must be a resistance grid in series between the transformer and the track to prevent overloading the transformer by the presence of a train upon the track circuit. The single-phase frequency relays may be any type designed to operate upon a single-phase circuit at a predetermined frequency, for instance, at 60 cycles, and to

as to give the proper phase relation between the two lines, one to be used for track circuit purposes only, and the other for one of the relay windings or any other purposes requiring current as, for the operation of signals; hence, it will be seen that by this arrangement any foreign current of a different frequency which may enter the line feeding the track phase of the track relay, will energize that winding only. The transformers for track circuits of this kind are similar to those described for single-phase track circuit equipment as are also the impedance bonds.

The principal difference between track circuits using a single-phase and polyphase track relay is that with single-phase relays it is necessary to install the track transformer for track circuits of more than 1,900 feet in the center of the circuit. The transformer for track circuits using polyphase relays is placed at one end of the circuit and the track winding of the relay connected to the track at the other end. The polarity of the track relays and track transformers alternate at adjacent track circuits so that in case of a broken down insulated joint, power from the adjacent track circuit will reverse the polarity of the track winding. The outline of the track circuits for alternating current propulsion as above described may be used for any voltage of alternating current or direct current, the principal conditions being that with the increase in voltage for propulsion purposes there is a corresponding decrease in magnitude of the impedance bonds due to the corresponding decrease in current for propulsion purposes at any predetermined load.

Physical Characteristics.

To describe systems of signals in use where alternating

*From the Journal of Railway Signal Association.

All functions are Electro Pneumatic
operated by Direct Current.

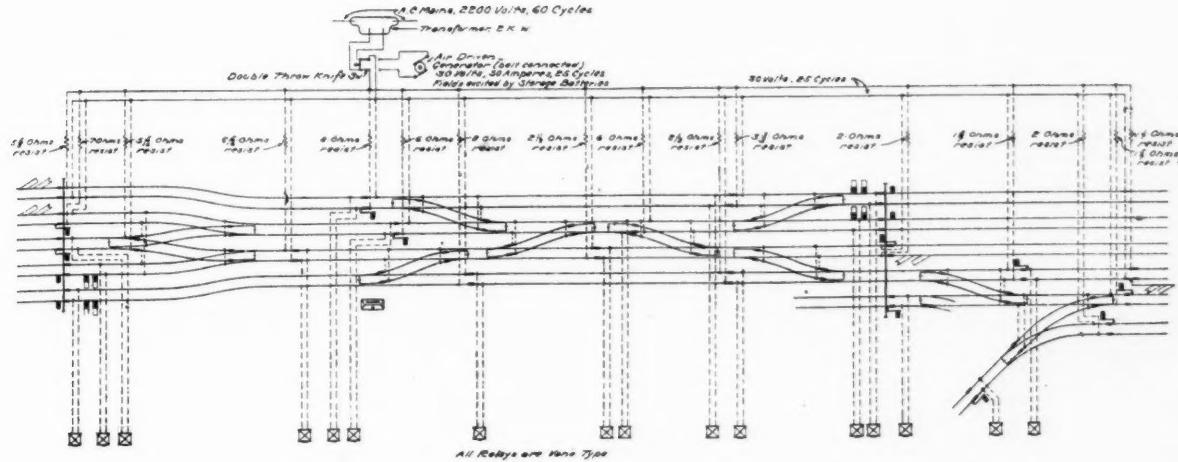


Fig. 24.

current propulsion is in service will require more space than can be given to this report. Your committee will, therefore, confine itself to the principal characteristics to be embraced in any signal system to be operated where alternating current propulsion is used. These characteristics are primarily to meet the conditions due to electro-magnetic and electrostatic induction upon the signal circuits from the propulsion lines.

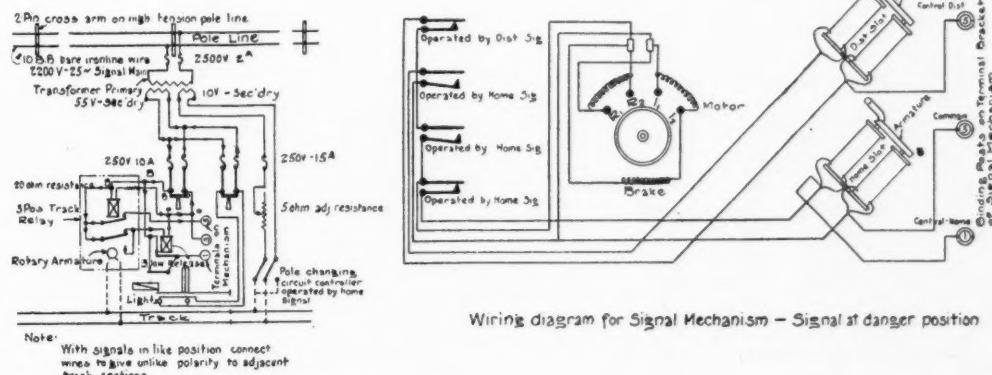
Line.

A single-phase propulsion system consists of an aerial line for supplying current to electric trains and a grounded line, i. e., the track and the ground connection, to carry the propulsion current from the trains back to the power stations, therefore, we have in this a single primary coil of a gigantic coreless transformer. Any line running parallel with the aerial line and grounded at each end will form the secondary coil of this giant transformer, therefore, it is obvious that there will be an induced current in the secondary coil due to magnetic induction proportionate to the number of amperes flowing over the propulsion feed lines. It is also obvious that the greater the length of the trolley transmission line and the grounded parallel line, the greater become the coils of the gigantic transformer and also a corresponding greater voltage will be induced in the secondary or grounded line.

In constructing a signal system, whether of the manual controlled or automatic, it is necessary to consider this impressed voltage, due to magnetic induction upon the signal lines and although the signal circuits in themselves are metallic, any two grounds which may occur will create a secondary, the voltage of which is accumulative in direct ratio to the distance between the grounds with a given amperage on the transmission line. Considering this, the signal system must be so designed that with a maximum amperage upon the transmission propulsion lines, the impressed voltage upon the maximum continuous metallic signal line will not exceed a predetermined voltage limited by the insulation of the signal line, should the extreme ends of this metallic line become grounded. It has been found that in practice 150 impressed volts upon the signal line is a maximum with the signal line insulated from ground for a working voltage of 500; this allows a factor of safety of over 200 per cent for any abnormal load surges on the propulsion lines.

Static Induction.

In regard to the electrostatic induction, any metallic substance insulated from the ground and adjacent to single-phase alternating current lines will become statically charged. The intensity of this charge depends upon the voltage of the a. c. propulsion lines and the insulation of the metallic substance from the ground; therefore, it is obvious that in-



Wiring diagram for automatic block signal locations

Fig. 25. A, C. Signals. C, V, B, B.

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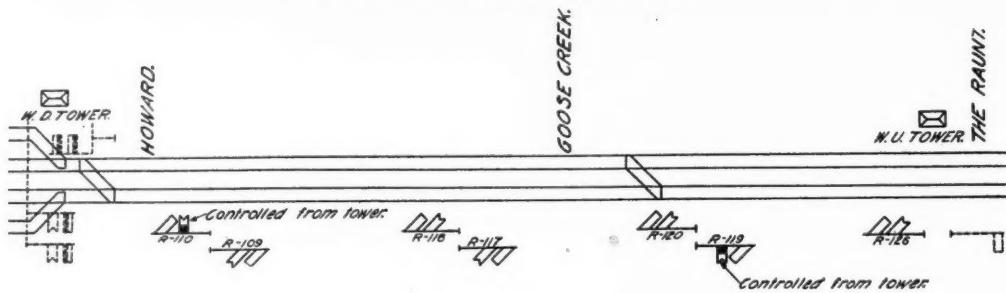


Fig. 1.

sulated metallic circuits used either for manually controlled block or automatic signal systems will become statically charged. It is, therefore, apparent that if the signal lines are close enough to a high voltage propulsion circuit they will become highly charged statically and break down any ordinary insulation unless provision is made to relieve the static charge. Inasmuch as the alternating current propulsion system is continuously in operation, the static charge is also continuous, likened perhaps to a miniature continuous flash of lightning and requires that the signal lines be equipped with the most approved type of lightning arrester, with a break-down voltage so low that the static will dis-

Power Supply.
Power to operate signals and other apparatus is furnished over a transmission line at voltages varying from 440 to 10,000 volts, and is stepped down to from 10 to 220 volts as necessity may require.

Track Circuits.

Track circuits are 60-cycle, single-phase and as far as installed are either for steam or d. c. propulsion and are also applicable to a. c. propulsion. Circuits consist of a track transformer with the primary connected to the main transmission leads and the secondary connected to the rails at the center of the track circuit. At each end of the track

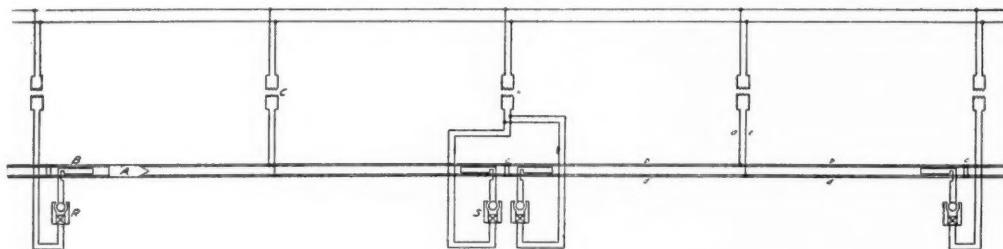


Fig. 2.

charge to the earth through the arrester before it would puncture the insulation of the signal system.

Installation of Signal System Using Alternating Current Track Circuits With Single-Phase Propulsion.

The first installation of a signal system using a. c. for track circuits with a. c. propulsion was installed in the states of New York and Connecticut during 1906 on the New York, New Haven & Hartford. The equipment for this installation was furnished by the General Electric Co., Westinghouse Electric & Mfg. Co., General Railway Signal Co., Union Switch & Signal Co., and the United Electric Apparatus Co., all signal equipment being installed by the signal department of the railroad.

Mileage.

Eight miles double track, twenty-two miles four-track and twelve miles six-track were installed.

circuit a single-phase frequency relay and a core impedance bond is connected to the rails and the center of the bond provided with a connection designed to carry the propulsion current to the next track circuit connecting with the center connection of a similar bond.

Track circuits of less than 1,900 feet require but one frequency relay, the transformer being connected at the end of the circuit in a similar manner to the usual method of connecting track batteries. The transformer is equipped with an adjustable filler, i. e., a laminated iron hanger is suspended between the coils of the transformer for adjusting the voltage to the track, the transformer also being arranged as a break-down or no voltage on the secondary coils when they are short circuited.

Signals.

Signals are of the Model 6 type furnished by the General Railway Signal Co.

Alternating Current Signaling on Steam Railroads.

Historical.

Since the advent of electric traction, one of the most difficult problems that signal engineers have had to solve was the prevention of leakage current from the electric roads entering the tracks of the steam roads and energizing the relays. With the growth of interurban electric roads paralleling the steam roads, this trouble rapidly multiplied. Numerous arrangements of direct current track circuits were tried with varied success to overcome this difficulty. Several steam roads are now experimenting with alternating current track circuits as a solution of the problem.

First Installations of Alternating Current Track Circuits on

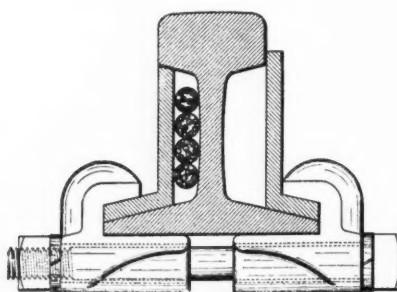


Fig. 3.

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Steam Railroads.**Union Pacific, Nebraska.**

The first installation of alternating current track circuits on steam railroads was on the Union Pacific between Union Pacific Transfer, Council Bluffs, and Missouri river bridge, during the latter part of 1906. The system comprised 16 track circuits covering a territory of about two miles of automatic block signals and one interlocking.

Power Supply.

The current for operating the track circuits and lighting the signals was obtained from a commercial electric light company at 400 volts 60 cycles, which is transformed to 8 volts for the track circuits and 55 volts for the electric lights. A steam driven generator for use in case of failure of power supply has been provided.

Track Circuits.

The track circuits average about 2,000 feet in length, the longest circuit being 2,823 feet. The tracks are bonded with iron bond wires.

Relays.

The relays are of the vane type, single phase, as previously described for use of electric roads except that they are wound to a higher impedance.

Signals.

The signals are of the Hall Signal Co.'s enclosed disc and the Union Switch & Signal Co.'s style "B" electric semaphore types, operated by storage batteries. Fig. 23 shows the arrangement of signals, track circuits, power supply, etc., of this installation.

Pennsylvania R. R.

The Pennsylvania has installed alternating current track circuits at four points: Union Tunnel, Baltimore, Md.; P. B. & W. Tunnel, Philadelphia; "W. K." Interlocking, Swissvale, Pa., and "C" Interlocking, Conemaugh, Pa., where leakage currents interfered with the proper operation of the direct current track circuits.



Fig. 4.

Union Tunnel, Baltimore.

In August, 1907, one alternating current track circuit was installed through this tunnel to control the signal governing northward movements. The circuit is 3,400 feet long; the tracks are bonded with two copper bond wires; a wire-wound armature type of polyphase relay is used.

"WK" Interlocking, Swissvale, Pa.

This installation was placed in service in February, 1908. It consists of 16 track circuits.

Power Supply.

The power supply for this installation is obtained from a commercial electric company at 2,200 volts 60 cycles. An emergency supply is provided for by a compressed air driven engine, driving a 30-volt 50-ampere 25 cycle generator. The compressed air is obtained from the air pipes that supply the switch and signal system.

Track Circuits.

The track circuits are supplied from one 2-kw. transformer located at the cabin, two feed wires from this transformer run the full length of the interlocking from which the track feeds are taken through resistance varying from one to eight ohms. The tracks are bonded with two No. 8 B. W. G. iron wires.

Relays.

The relays are of the Union Switch & Signal Co.'s vane type, wound to operate on 25 or 60 cycles.

Signals.

The signals are of the electro-pneumatic type, those governing the high-speed tracks are semi-automatic, the stick relays controlling these signals are of the slow releasing type to prevent the signals being thrown to the stop position when the alternating current supply is momentarily interrupted.

Switches.

The switches are of the electro-pneumatic type and are protected by electric detector and approach locking, no detector bars being used. Fig. 24 shows the arrangement of track circuits at this point.

P. B. & W. Tunnel, Philadelphia.

This installation was made in 1909. It consists of two track circuits through the tunnel south of West Philadelphia Station.

Conemaugh.

This installation was placed in service in March, 1910, and is along the same general lines as that at Swissvale, except that the Union Switch & Signal Co.'s galvanometer type of relays are used.

Cumberland Valley Railroad.

The first installation of automatic block signals on a steam road using alternating current for operating and lighting the signals, as well as the track circuits, was installed on the Cumberland Valley between Lemoyne and Mechanicsburg. The installation consists of 14 automatic and 2 semi-automatic signals, covering a territory of about 8 miles of double-track road.

Power Supply.

Power for operating the signal system is supplied from 2,200-volt, 25 cycle, alternating single-phase current line strung on the poles of the high-tension line along the right of way. Line wires consist of two No. 10 B. W. G. bare iron wires, current being delivered from the power plant located at Lemoyne, Pa., with lightning arresters installed at intervals of two miles. Total power required for the system is 3 K. V. A., power factor 0.76. The amount of current in the mains was so small that it permitted the use of No. 10 B. W. G. iron wire instead of copper wires, with 10 per cent line drop.

Signals.

All signals are style "B" electric lighted, three-position, upper right hand quadrant with a fixed position lower arm. The motors are of the induction type and have no contacts

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or brushes and no friction surfaces aside from the two armature bearings. Starting torque is secured by taking the current for one of the two motor windings through a reactance or lag-producing coil, which coil, when energized, performs the additional function of releasing the brake from the motor armature.

Line Transformers.

Line transformers are installed at each signal with taps to step voltage down from 2,200 volts to 55 volts for motors, and lights and 5 volts for track circuits controlled by resistances.

Relays.

Relays are galvanometer type for track circuits with a vane type relay for slow release control.

Track Circuits.

The polarized system of a. c. track circuits is used, which controls the third or clear position of the signals without the use of line wires, so that the two a. c. mains are the only line wires used in the automatic territory. Track circuits average one mile long with longest circuit 6,300 feet, no overlap.

Lights.

The small amount of energy used by the two c. p. electric lights of the signals does not justify putting them out in

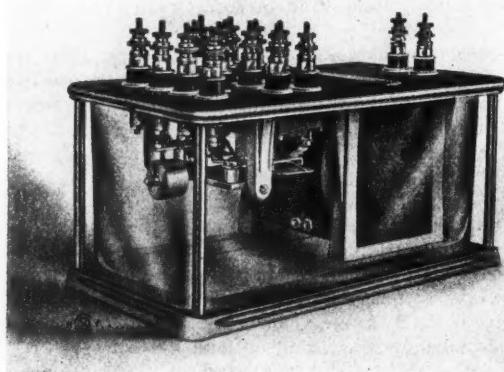


Fig. 5.

the day time. Lamps are renewed before the expiration of their estimated life. The top arms of the home signals at the mechanical interlocking plant at White Hill, which is within the automatic territory, are operated by a. c. motors, the same as the automatic block signals, but are controlled by levers in the machine in addition to the track circuit. Circuit controllers on these signals and their respective distant signals control indication locks which are operated by a. c. on the machine levers. No batteries are used on any part of the system, which incidentally permits the bottom compartment of the signal case to be used for a relay and instrument case. The use of electric lights on the signals not only avoids the expense of maintaining oil lights, but gives better service in that there is no smoking and fewer failures of the light. The maintenance expense is limited chiefly to the proper lubrication of the signal mechanism and the care of the bonding and rail insulated joints, so that as a system it is in harmony with modern improvement, in that machinery is substituted for hand labor. Fig. 25 shows the automatic signal and motor circuits of this installation.

Jointless Track Circuits.

A signaling system that does not require the use of insulating joints for main tracks was placed in service on the Rockaway Beach division of the Long Island Railroad in June, 1908, between Ramblersville and the Raunt Station. On this division of the Long Island the electric trains are operated by the third rail system, with 500-volt d. c. current

for propulsion. At the sub-stations an a. c. current is transformed from 6,600 volts, 25 cycles, to 2,200 volts a. c., 25 cycles, at which voltage it is carried through the different sections of the road where automatic block signals are used, on two No. 2 bare copper wires for the signal supply current. As the territory through which the new signals were installed is on a trestle over Jamaica bay, it was considered objectionable to use a high voltage on the trestle, accordingly a step-down transformer of 3 kw. capacity was placed in the signal supply line at the west end of the trestle to reduce the voltage to 220, which is the voltage used for the signal supply for the new system.

Figure 1 shows the locations of the signals installed with this system of track circuit control. It will be noted that the signals for both directions are on the same side of the tracks; this was found necessary in order to obtain a view of the signals because the pole line obstructed the view on the opposite side of the tracks. The blocks are approximately 2,700 feet in length, and home and distant signals are used as on other sections of the road.

At each signal location a storage battery of five cells in duplicate of the Standard Electric Accumulator Co.'s battery, charged from the third rail through resistances, is used for the operation of the motors and slots. At one of the signal locations, however, the storage battery is not used, but in its place is substituted a rectifier of special design, which is connected to the a. c. supply through the regular relay transformer, which provides direct current at 12 volts for the operation of the motors and slot magnets at this location. The use of this rectifier is an interesting detail of the installation, since, by its use, a direct current supply is provided from the same a. c. source as is used for the track circuit, which allows the use of standard signal apparatus with d. c. motors and slot coils.

Figure 2 shows the track circuit. At each signal two No. 4-0 copper cross bonds connect the rails, forming a short circuit between the rails at these points. A track transformer, the primary of which is connected to the signal supply wires and the secondary to the two rails, and which supplies a. c. at 25 cycles, at approximately 4 volts, to the track is provided at the center of each block. The path for this current is from secondary connection a to rail b, cross bond c, rail d, connection e, to the other side of the transformer secondary. At the same time a current of equal value passes from secondary connection a, rail b-1, cross bonds c-1, rail d-1 to the transformer; so that the a. c. passes continuously through both rails throughout the block. At each end of the block a coil of wire is placed along the rails with its terminals connected to the armature of an a. c. relay of the two circuit type. This coil is composed of 40 turns of No. 10 insulated copper wire, wound continuously as in a transformer or magnet coil, along and between the rails. The wire is protected from mechanical injury by angle irons along the rails and clamped to them and by wood trunking between the rails. Angle irons are also clamped to the outside of the rails. These angle irons, in addition to forming protection to the coils, increase their electrical efficiency by providing a core. A sectional view of the rail, coil and angles is shown in Figure 3.

The coil is thirteen feet six inches in length, and is made of well insulated flexible wire, impregnated with a weather-proof compound. The size and construction of this coil is such that it can be placed between the track joints when the ordinary thirty-foot rails are used. Where the coil passes between the rails it is placed below the base of the rail, so that the top of trunking which protects it is no higher than the top of tie, which construction provides ample protection from mechanical injury from parts dragging from cars. Figure 4 is a photograph of two of the coils in place, and gives

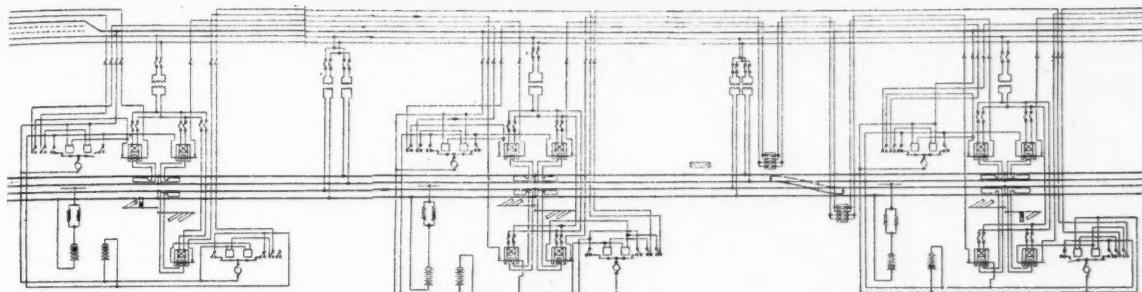


Fig. 6.

an idea of the freedom from interference to traffic and road bed which the use of these coils provides.

The a. c. which passes along rail b, cross bonds c and rail d induces a current of the same frequency in the coil, and this induced current is carried through the armature winding of the two circuit relay R. This action on the coil is the same as the action of a transformer; the rails through which the initial current passes form the primary of the transformer, the angles and clamps form the core, and the coil forms the secondary of the transformer. The fields of the relay are connected directly to the main signal supply wires through a field transformer, which reduces the supply from 220 volts to 55 volts, and in addition to supplying a. c. at 25 cycles, 55 volts, to the fields of the relays at this location, also provides current at the same voltage for the rectifier.

A cut of the relay is shown in Figure 5. It is designed on the principle of the D'Arsonval type of electrical instrument with a moving coil enclosed in a stationary field. The contact fingers of the relay are attached to the moving coil or armature, and in order to have a closed contact, it is necessary to have a current of the same frequency pass through both field and armature coils in synchronism. As the a. c. from the supply at 25 cycles passes through the field coils continuously, the operation of the relay is dependent upon the current from the same source, through the track coils.

The signal circuit, diagram of which is shown in Figure 6, is a normally clear wire circuit with home and distant control. The wire for each home signal is carried through the home block in order that the home signal may be controlled through a contact on the relay at each end of the block in series circuit.

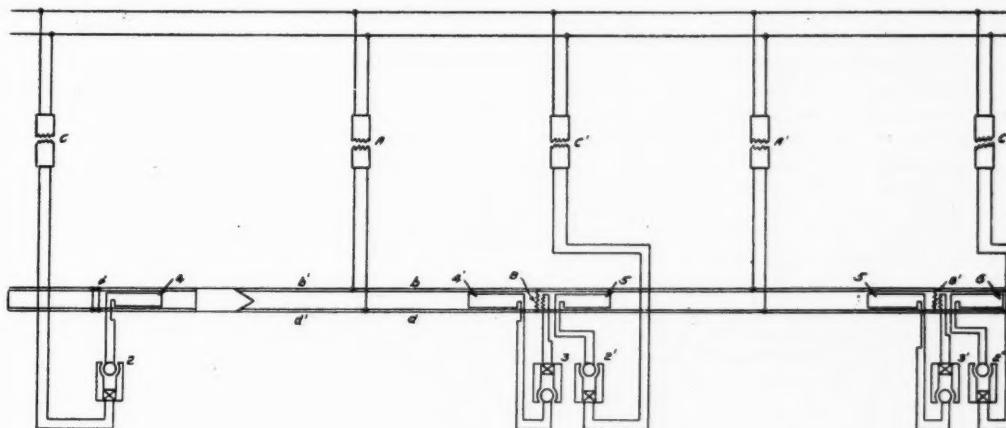
The breaking of a cross bond causes the signal to go to

the stop position because the circuits from the transformers on each side of the bond are broken. When, however, a train is between two adjacent track transformers it completes a circuit from each. The connections of the transformers and relays are made in such a manner that the train approaching the broken bond clears the signal in advance, but the current to the train from a source to the rear will not give a clear indication. Broken rail protection is also afforded on both rails, since a broken rail will cut off the supply to the track coil at one end of the block and de-energize the relay at that end. It is also feasible with this system to cross-bond between tracks on a two or more track road at each signal location without interference with the operation of the system or the protection afforded by it.

The amount of energy consumed for each track circuit will vary in accordance with the length of section, condition of ballast, etc. On this installation the track transformer delivers 30 amperes at 3.3 volts or 99-volt amperes, and the field transformers deliver 2 amperes at 55 volts or 110-volt amperes. The power factor of the transformers, however, is low, and the actual consumption of energy for each section is only approximately 90 watts.

A later design of track circuit is shown in Figure 7 which provides an overlap and eliminates all dead section between blocks. The primary of the transformer "B" serves as a cross bond between rails, and the secondary furnishes current to the field of the relay "3" at the exit of the block, the armature of this relay is energized by the track coil as usual.

The relay at the entrance end of the block has its field supplied by the line transformer and is not affected by the approach of a train. In the operation of this circuit when the train passes the cross bond "1" it de-energizes the relay "2" and the signal at this location goes to stop, this relay remaining down until the train passes the transformer "A"



A.C TRACK CIRCUIT WITH OVERLAP

Fig. 7.

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some distance. When the train gets within a few rail lengths of where transformer "A" is connected to the track it short circuits it sufficiently to de-energize relay 3.

The signal at Bond "1" being controlled through relays "2" and "3" it is held at stop as long as either one is down, and relay "3" is de-energized until the train has passed some distance beyond transformer "B" as the wheels and axles rob it of current and de-energize the field. The length of the overlap is about 150 feet. Where the transformer "B" is used to obtain an overlap, it is positively essential that all the track transformers be connected with the same polarity on one rail, in order to induce current in the secondary of transformer "B" and energizes the field of relay "3." Where all the track transformers are connected with the same polarity to one rail, it is impossible to get a false clear signal from a broken or loose cross bond, as the current from an adjacent block would be in the wrong direction.

IMPROVEMENTS IN RAILWAY SIGNALING.*

J. S. Hobson, Assistant General Manager, The Union Switch & Signal Company.

It is somewhat difficult to point out particular improvements in railway signaling material and methods made during the last twelve months which are sufficiently marked to be interesting to anyone not familiar with the details of the subject. In general, the progress made in our branch of engineering has been more along the lines of developing designs already in general use, than in making radical changes in design or in placing entirely new apparatus on the market.

The interlocking and signaling for the new terminal of the Pennsylvania Railroad in New York city is a striking example of this, since, while that installation is the very latest development in railway signaling, it differs little in general principles from similar plants installed during the past five years. The most noteworthy features of this installation comprise means for obtaining the positive control of interlocking signals by the actual position of the switches or switch they govern; the automatic control of such signals by track conditions; the automatic locking of all switches in every route by the entrance of trains thereon, and their automatic release immediately the rear end of a train has passed clear of the fouling point of the track including each switch. The special features further comprise means for giving visual indications to the tower operator of every act of a train in actually locking and releasing levers controlling switch and signal operation, and means for permitting the joint use of all tracks for traffic in either direction between adjacent towers, by the co-action of towermen and track conditions.

The foregoing are, however, developments of methods previously in use in other plants, and while, in a sense, improvements, are not radical. There is, however, one somewhat original improvement in the Pennsylvania Terminal installation, used for the first time to any extent; namely, the control of electro-pneumatic valves through magnets actuated by alternating current. The use of alternating current for the operation of signal apparatus has been steadily growing for the past seven years, and the twelve-month just passed represents a more rapid growth of its use than any previous year. Alternating current was first used to any extent in signal apparatus for the operation of track circuits on electric railways, employing either alternating or direct current for propulsion purposes, but now its use has gradually been extended to the operation of signals, indicators, locks, etc.

A new field has very lately been opened for signal apparatus on interurban electric railways, the managers of which are taking a very keen interest in this subject, several

contracts of this kind having just been closed by this company. Since their conditions differ somewhat from the electrified sections of steam railroads, certain modifications have been made in alternating-current signal apparatus, resulting in improvements tending to increase its efficiency. For example, by modifications in the design of alternating-current relays, transformers, etc., the length of track circuits which can be operated without relaying has been materially increased, and the cost of installing alternating-current automatic block systems reduced accordingly.

The only other striking improvement in signal apparatus has been the development of the electro-mechanical interlocking system, in which the switches and their locks are operated manually and controlled electrically, the signals being electrically operated. This system possesses the combined safety features of manual and power operated interlockings at a cost about midway between the two. Its use is confined to plants where the farthest switch is located within about 800 feet of the operating levers, and so far it has not been applied to interlockings of any considerable magnitude, or where the rapid operation of switches and signals is necessary, such as in terminal yards. However, very many interlockings can be satisfactorily operated by it, and its use is rapidly increasing.

Numerous minor developments in products have been made during the past year, as, for example, the improving of insulation in electrical material, the standardization of details to fit them for more universal application, and the modification of designs to cheapen the cost of production and expedite delivery of orders, among which may be mentioned the substitution of drop forgings for parts previously made of malleable iron, which from the nature of its manufacture cannot be furnished on short notice.

As an example of the improvement in the design of electrical apparatus, porcelain and insulating moulded material has been substituted, in many instances, for parts previously made of metal and insulated from their electrical connections by bushings and washers.

RAILWAY SIGNAL ASSOCIATION COMMITTEES FOR 1911.

Committee I—Signaling Practice and Standards.

(a) Continue investigation and report on a uniform system of signaling. (b) Continue work on standard designs. Progress reports should be submitted at the March and June meetings. (c) Chairman of committee will advise chairmen of committees II, III and IV from time to time of work to be performed by his committee, which will affect the work of these committees.

A. H. Rudd, Chairman, P. R. R., Philadelphia, Pa.
L. R. Clausen, Vice-Chairman, C. M. & St. P., Chicago.
C. C. Anthony, P. R. R., Philadelphia, Pa.
H. S. Balliet, N. Y. C. & H. R., Grand Central Terminal, New York City.

C. A. Christofferson, Northern Pacific, St. Paul, Minn.
C. E. Denney, L. S. & M. S., Cleveland, O.

W. J. Eck, Southern Ry., Washington, D. C.

W. H. Elliott, N. Y. C. & H. R., Albany, N. Y.

G. E. Ellis, K. C. T., Kansas City, Mo.

A. S. Ingalls, L. S. & M. S., Cleveland, O.

J. C. Mock, Detroit River Tunnel Co., Detroit, Mich.

F. P. Patenall, B. & O., Baltimore, Md.

J. A. Peabody, C. & N. W., Chicago, Ill.

W. B. Scott, Harriman Lines, Chicago, Ill.

A. G. Shaver, Rock Island Lines, Chicago, Ill.

T. S. Stevens, A. T. & S. F., Topeka, Kan.

H. H. Temple, B. & O., New Castle, Pa.

J. C. Young, Union Pacific, Omaha, Neb.

Committee II—Mechanical Interlocking.

(a) Investigate and recommend a device or arrangement that with slotted power-operated home signals will equally

*From the Electric Journal.

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well secure the safety of operation of mechanical interlocking apparatus that is at present afforded by the bolt lock in mechanical plants with pipe-connected units. (b) Reconsider the specifications for concrete foundations for signal apparatus, considering the reports submitted by the various committees at the last annual meeting and the specifications of the American Railway Engineering and Maintenance of Way Association, and submit reports for discussion at the March and June meetings, if possible, and for adoption at the annual meeting. (c) Prepare specifications for interlocking for drawbridges. Specify particularly the requisites for locking rails and interconnecting rail-locks, bridge-locks, wedges and the interconnection of these with derails and signals protecting the drawbridge. (d) Submit floor and leadout plans for mechanical interlocking cabins.

C. J. Kelloway, Chairman, Atlantic Coast Line, Wilmington, N. C.

F. C. Stuart, Vice-Chairman, Sunset Lines, Houston, Tex.
S. T. Brotzman, L. V., Taston, Pa.
L. Brown, A., T. & S. F., Topeka, Kan.
F. H. Buchanan, Vandalia, Terre Haute, Ind.
G. W. Chappell, N. Y., N. H. & H., New Haven, Conn.
J. Diefenbach, St. L. & S. F., Memphis, Tenn.
E. C. Graham, B. & A., Boston, Mass.
E. Hanson, G., C. & S. F., Cleburne, Tex.
William Hiles, C., C. C. & St. L., Cincinnati, O.
J. A. Johnson, M., K. & T., Denison, Tex.
T. A. Jones, P. R. R., Philadelphia, Pa.
T. E. Kirkpatrick, L. S. & M. S., Elkhart, Ind.
J. W. McClelland, P. & R., Philadelphia, Pa.
E. E. Mack, C. & E. I., Danville, Ill.
W. B. Morrison, D. L. & W., Newark, N. J.
S. Miskelly, Rock Island Lines, Chicago, Ill.
E. J. Relph, Northern Pacific, St. Paul, Minn.
Charles Stephens, C. & O., Richmond, Va.
J. I. Vernon, N. Y., N. H. & H., Boston, Mass.
C. H. Wiegand, N. Y. C. & H. R., Spuyten Duyvil, N. Y.
W. F. Zane, C., B. & Q., Chicago, Ill.

Committee III—Power Interlocking.

(a) Continue investigation and submit the following typical plans for electric interlocking: Circuits for one-arm signal and single switch; circuits for selecting signals; switch detector circuits; route locking circuits; approach locking circuits. (b) Investigate and recommend a device or arrangement which will equally secure the safety of operation of electric interlocking apparatus that is at present afforded by the bolt lock in mechanical plants with pipe-connected units. (c) Reconsider and complete specifications for electro-pneumatic interlocking on the lines of the specifications for electric interlocking. (d) Submit plans similar to those mentioned in (a), for electro-pneumatic interlocking.

B. H. Mann, Chairman, Mo. Pacific Ry., St. Louis, Mo.

W. F. Follett, Vice-Chairman, N. Y., N. H. & H., New Haven, Conn.

W. H. Arkenburgh, Rock Island Lines, Chicago, Ill.

W. A. Bartley, Interborough Rapid Transit, New York City.

E. J. Clark, P. R. R., Wilkinsburg, Pa.

M. H. Collins, Hudson & Manhattan Tunnel Co., New York City.

J. R. Decker, Mich. Central, Detroit, Mich.

G. B. Gray, Penn. Lines West, Pittsburgh, Pa.

W. H. Harland, N. Y. O. & W., Middletown, N. Y.

R. C. Johnson, N. Y. C. & H. R., New York City.

H. K. Lowry, C. M. & St. P., Milwaukee Shops, Wis.

W. N. Manuel, G. R. & I., Grand Rapids, Mich.

G. A. Motry, B. & O., Pittsburgh, Pa.

H. H. Orr, C. & E. I., Chicago, Ill.

W. M. Post, P. R. R., Jersey City, N. J.

I. S. Raymer, P. & L. E., Pittsburgh, Pa.

A. H. Rice, D. & H., Albany, N. Y.
D. W. Rossell, N. Y. C. & H. R., New York City.
Hal Smith, Union Pacific, Manhattan, Kan.
F. B. Wiegand, L. S. & M. S., Cleveland, O.
E. Winans, A. T. & S. F., Topeka, Kan.
A. H. Yocom, P. & R., Philadelphia, Pa.
G. A. Ziehlke, Union Pacific, Omaha, Neb.

Committee IV—Automatic Block.

(a) Reconsider the specifications for direct current relays, referred back to the committee at the last annual meeting, and submit new specifications based as far as possible on the association's present specifications. (b) Continue work on detailed specifications for material, taking them up in the order shown in the report submitted at the last annual meeting. (c) Supply typical automatic signal circuits for single and double-track railways.

A. G. Shaver, Chairman, Rock Island Lines, Chicago, Ill.
J. M. Fitzgerald, Vice-Chairman, N. Y. C. & H. R., Albany, N. Y.
E. L. Adams, L. S. & M. S., Cleveland, O.
E. A. Allen, Northern Pacific, St. Paul, Minn.
J. G. Bartell, L. V., Easton, Pa.
G. R. Cowherd, A. T. & S. F., La Junta, Colo.
G. E. Ellis, Kansas City Term., Kansas City, Mo.
E. A. Everett, M. C., Detroit, Mich.
J. C. Finch, Mo. Pacific, St. Louis, Mo.
A. R. Fugina, L. & N., Louisville, Ky.
J. E. Gillmor, Penn. R. R., Philadelphia, Pa.
W. H. Higgins, C. R. R. of N. J., Elizabeth, N. J.
A. B. Himes, B. & O., Newark, O.
S. P. Hull, N. Y. C. & H. R., Albany, N. Y.
W. R. Hastings, Rock Island Lines, Chicago, Ill.
E. W. Kolb, B. R. & P., Rochester, N. Y.
E. W. Newcomb, Oregon Short Line, Ogden, Utah.
F. W. Pfleegling, Union Pacific, Cheyenne, Wyo.
H. J. Rhinehart, D. L. & W., Hoboken, N. J.
A. H. Rice, D. & H., Albany, N. Y.
L. W. Smith, C. M. & St. P., Milwaukee, Wis.
T. S. Stevens, A. T. & S. F., Topeka, Kan.
F. E. Wass, N. Y. C. & H. R., New York City.
C. P. Woodson, Penn. Lines West, Bradford, O.

Committee V—Manual Block.

(a) Submit description of, and circuits for various controlled manual block signal installations now in service in the United States and Canada. (b) Supply similar information and circuits for staff installations.

J. B. Latimer, Chairman, C., B. & Q., Chicago, Ill.
L. R. Mann, Vice-Chairman, Mo. Pacific, St. Louis, Mo.
J. Beaumont, Chicago Great Western, Chicago, Ill.
J. H. Cormick, Northern Pacific, St. Paul, Minn.
H. J. Foale, Wabash, Decatur, Ill.

Committee VI—Automatic Stops and Cab Signals.

Continue investigation and report the results of tests of any installations which are made during the year.

R. C. Johnson, Chairman, N. Y. C. & H. R., New York City.

H. K. Lowry, Vice-Chairman, C., M. & St. P., Milwaukee Shops, Wis.

E. T. Ambach, C. H. & D., Cincinnati, O.

Hadley Baldwin, Big Four, Mattoon, Ill.

W. R. Hastings, Rock Island Lines, Chicago, Ill.

J. B. Lamb, Southern Ry., Washington, D. C.

E. K. Post, Penn. R. R., Media, Pa.

Committee VII—Subjects and Definitions.

Prepare definitions for technical terms connected with signaling, particularly any terms which discussions show are not properly defined.

C. C. Anthony, Chairman, P. R. R., Philadelphia, Pa.

J. C. Mock, Detroit River Tunnel Co., Detroit, Mich.

F. P. Patenall, B. & O., Baltimore, Md.

RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

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Committee VIII—Arrangements.

Make all necessary arrangements for the annual meeting. T. S. Stevens, Chairman, A., T. & S. F., Topeka, Kan. E. W. Newcomb, Vice-Chairman, Oregon Short Line, Ogden, Utah.

A. H. McKeen, Southern Pacific Co., Portland, Ore. C. C. Rosenberg, Bethlehem, Pa. W. J. Gillingham, Hall Signal Co., Chicago, Ill. J. S. Hobson, U. S. & S. Co., Swissvale, Pa. F. A. Poor, Rail Joint Co., Chicago, Ill.

Committee IX—Wires and Cables.

(a) Continue investigation, especially in regard to tests for rubber insulation. (b) Prepare specifications for wires or cables for any special uses, which are not covered by the adopted specifications. (c) Continue investigation as committee thinks desirable in regard to inspection of wire by wire inspection bureaus, making recommendations accordingly.

W. H. Elliott, Chairman, N. Y. C. & H. R., Albany, N. Y. E. L. Adams, Vice-Chairman, L. S. & M. S., Cleveland, O. W. L. Dryden, Staten Island R. T., St. George, L. I., N. Y. G. S. Pfasterer, N. C. & St. L., Nashville, Tenn. J. D. Phillips, P. & R., Reading, Pa. D. W. Richards, N. & W., Roanoke, Va. V. I. Smart, Prof. McGill University, Montreal, Can. M. E. Smith, D. L. & W., Hoboken, N. J. E. L. Watson, Penn. R. R., Harrisburg, Pa. J. M. Waldron, I. R. T. Co., New York City. J. V. Young, B. & M., Boston, Mass. J. W. Young, Erie, Jersey City, N. Y.

Committee X—Electric Signaling for Electric Railroads.

(a) Continue investigation and make further report on the various systems in satisfactory operation. (b) Prepare specifications for alternating-current operated automatic signal installations on electric railroads. If it can be done, it is advisable to submit brief of proposed specifications at the March meeting.

H. S. Balliet, Chairman, Grand Cent. Term., New York City. C. H. Morrison, Vice-Chairman, N. Y., N. H. & H. R., New Haven, Conn. W. P. Allen, Penn. R. R., Philadelphia, Pa. Wm. A. Bartley, I. R. T. Co., New York City. M. H. Collins, Hudson & Manhattan, New York City. W. F. Follett, N. Y., N. H. & H. R., New Haven, Conn. E. C. Grant, Union Pacific, Omaha, Neb. W. F. Hudson, N. Y. C. & H. R., New York City. John Leisenring, Illinois Traction System, Peoria, Ill. H. A. Logue, Cumberland Valley, Chambersburg, Pa. W. W. Morrison, N. Y. C. & H. R., New York City. C. A. Peddle, I. R. T. Co., New York City. E. B. Smith, N. Y. C. & H. R., New York City. Chas. Soper, L. I., Jamaica, L. I., N. Y. W. N. Spangler, Penn. Tunnel & Term., New York City. H. S. Towle, Erie, Pa., N. J. W. Tyler, L. I., Richmond Hill, New York, N. Y. H. C. Ware, N. Y. C. & H. R., Albany, N. Y. F. E. Wass, N. Y. C. & H. R., New York City.

Committee XI—Manual.

Review the journals and make a report on subjects which have been approved by the association and should be included in the Manual.

F. P. Patenall, Chairman, B. & O., Baltimore, Md. C. C. Anthony, Penn. R. R., Philadelphia, Pa. W. J. Eck, Southern Ry., Washington, D. C. W. H. Elliott, N. Y. C. & H. R., Albany, N. Y. C. C. Rosenberg, Bethlehem, Pa.

Committee XII—Contracts.

(a) Submit recommended form for contracts for joint interlocking plants. If possible, submit brief outline of proposed contract for discussion at the March meeting. (b)

Recommend basis for division of expense of construction, operation and maintenance of joint interlocking plants.

L. R. Clausen, Chairman, C. M. & St. P., Chicago, Ill. C. A. Christofferson, N. P. Ry., St. Paul, Minn. R. L. Huntley, Union Pacific, Omaha, Neb. E. B. Pry, Penn. Lines West, Pittsburg, Pa. L. S. Rose, C. C. & St. L., Cincinnati, O. Geo. Boyce, C. St. P., M. & O., St. Paul, Minn. J. B. Latimer, C. B. & Q., Chicago, Ill.

Special Committee—Promotion of Signaling Education.

Continue investigation and compilation of data on all subjects pertaining to signaling.

W. J. Eck, Chairman, Southern Ry., Washington, D. C. F. W. Bender, C. R. R. of N. J., Elizabeth, N. J. A. D. Cloud, The Signal Engineer, Chicago, Ill. H. C. Williams, N. Y. C. & H. R., Utica, N. Y.

Special Committee—Method of Recording Signal Failures.

Reconsider forms submitted at the last annual meeting, paying particular attention to the points discussed, and secure information, if possible, from roads using the reports submitted, making a complete report at the annual meeting.

J. C. Young, Chairman, U. P., Omaha, Neb. H. W. Lewis, Vice-Chairman, L. V., South Bethlehem, Pa. D. M. Case, C. N. O. & T. P., Lexington, Ky. J. R. Decker, Mich. Central, Detroit, Mich. G. H. Dryden, B. & O., Baltimore, Md. E. C. Hitchcock, N. Y., N. H. & H. R., New Haven, Conn. L. L. Whitcomb, L. S. & M. S., Elyria, O.

Special Committee—Storage Battery.

(a) Continue standardization of parts and accessories of storage cells. (b) Prepare specifications for portable cells. (c) Investigate and report on designs for housing of storage batteries for interlocking and automatic signal work.

A. H. Yocom, Chairman, P. & R., Philadelphia, Pa. G. E. Beck, L. S. & M. S., Toledo, O. J. Fred Jacobs, C. R. R. of N. J., Easton, Pa. A. H. McKeen, Southern Pacific Co., Portland, Ore.

In accordance with the revised constitution of the association, the board of direction (formerly "executive committee") has been increased in number to 15. This action was taken at a meeting of the old executive committee at Buffalo, and the new board is made up as follows: C. E. Denny, president; C. C. Anthony and B. H. Mann, vice-presidents; C. C. Rosenberg, secretary; H. S. Balliet, L. R. Clausen and A. H. Rudd, three past presidents; F. P. Patenall and A. G. Shaver; and the following new members, the first two of whom are to hold office until the next annual meeting and the other four for twelve months longer:

F. C. Stuart, Sunset Route. J. V. Young, Boston & Maine. C. A. Christofferson, Northern Pacific. W. J. Eck, Southern. E. W. Newcomb, Oregon Short Line. T. S. Stevens, Atchison, Topeka & Santa Fe.

W. D. Hodge, chief engineer of the Denver, Laramie & Northwestern at Denver, Colo., has been appointed also general superintendent, with office at Denver, succeeding D. L. Hutchison, superintendent and assistant chief engineer, resigned.

R. B. Harris has been appointed supervisor of subdivision No. 3, Allegheny division, of the Pennsylvania railroad, with office at South Oil City, Pa., succeeding A. G. Follette, transferred.

M. C. Blanchard, roadmaster of the Atchison, Topeka & Santa Fe, at Florence, Kan., has been appointed division engineer, with office at Topeka, Kan., succeeding C. E. Griggs, transferred to the operating department.

J. Singleton, roadmaster of the Rock Island Lines at Sibley, Ia., has been appointed roadmaster, with office at Des Moines, Ia., succeeding W. F. Lee, deceased. H.

Berend, section foreman at Waterloo, Ia., succeeds Mr. Singleton.

The chief engineer's department and the engineer of branch lines' department of the Pennsylvania Railroad have been consolidated. Joseph U. Crawford, engineer of branch lines, at Philadelphia, Pa., has been appointed consulting engineer, and H. E. Booz, principal assistant engineer of branch lines, has been appointed an assistant chief engineer, both with offices at Philadelphia, Pa., and their former positions have been abolished.

P. A. Pheney, roadmaster of the Idaho division of the Oregon Short Line, at Glens Ferry, Idaho, has been appointed roadmaster, with office at Nampa, Idaho, succeeding T. Donovan, deceased. Patrick Brennan succeeds Mr. Pheney. F. Reilly, roadmaster on the Salt Lake division of the Southern Pacific lines east of Sparks at Mina, Nev., has been transferred to Wells, Nev., succeeding A. E. Moquist, and Mr. Moquist succeeds Mr. Reilly.

Hearing on Electric Interurban Railway Operating Methods in Illinois and Indiana.

In response to a bulletin sent to all electric railway managers in Illinois by the Railroad and Warehouse Commission, 30 representatives of interurban railways attended a hearing before the Commission on Dec. 20, 1910, at Springfield. Orville F. Berry, chairman of the Commission, presided at the meeting. In his address, in which he set forth the general views of the Commission with reference to the development of the interurban railways of the state, he said in part: "The construction of double track at curves and the installation of automatic signals should be considered and worked out as rapidly as possible." He said that the Commission is highly pleased at the improvements the Illinois Traction System is making, looking toward greater safety of operation. A discussion on the subject of the training of employees followed his address. This and the consideration of related subjects occupied the time of the meeting during the morning session.

At the afternoon session John Leisenring, signal engineer of the Illinois Traction System, described the signaling now being installed under his direction on that road. This includes continuous automatic blocking for 100 miles, and signal protection for all bad curves on the system. The first installation of signals will be on the congested track between Springfield and St. Louis. Each siding on the less congested stretches is to have four signals. The total cost of the work now under way and to be undertaken during the next few months will be \$1,500,000, some parts of the work costing as much as \$3,000 per mile. Mr. Leisenring referred to the automatic stop in use on the Washington Water Power Railway, and said that his road has some such arrangement under consideration.

H. E. Chubbuck, vice-president of the Illinois Traction System, referred to the dispatcher's signals of the Blake Signal & Mfg. Co., which are being installed on 200 miles of track at an expense less than that of the straight automatic block system. He also mentioned the signals which the Baird Electric Co. is furnishing for 100 miles of line. Both types of signals facilitate train operation, being under control of the dispatcher at all times, and are similar to the form of signal recently approved by the Indiana Railroad Commission.

Edwin C. Faber, general manager of the Aurora, Elgin & Chicago, said that his road recently installed two blocks covering 1½ miles of track at an approximate cost of \$7,000. A general discussion as to the applicability of automatic train stops to interurban operation showed the consensus of opinion to be that these have not been sufficiently perfected to be adapted to interurban service.

H. A. Fisher, president of the Joliet & Southern Traction Co., described the installation of signals made by the United States Electric Co. as very satisfactory. This system cost up to \$250 per mile, and was safe for speeds up to 40 miles per hour, and improvements now being made in the trolley contact would soon make possible its use at much higher speeds. This signal system, he said, would undoubtedly be satisfactory for many smaller roads.

A meeting of interurban officers was called for Jan. 19, 1911, to form an association of electric railways in Illinois. At this meeting a committee of five was selected to frame a summary of the suggestions brought up at the meeting of Dec. 20, and to bring this summary before the Legislature. Commissioner Berry said, in closing the meeting, that Governor Deneen would recommend legislation to enlarge the powers of the Railroad and Warehouse Commission. The committee of five would work with the Commission in the preparation of the bill to cover the enlargements.

At a joint meeting of representatives of the interurban railways of Indiana and state officials, held on Dec. 13, 1910, at Indianapolis, Ind., the recommendations of the Railroad Commission of that state were presented and discussed. Among these recommendations was one that the interurbans install block signals on their lines as soon as practicable possible. Regarding this recommendation a number of the representatives present said that their roads were already partly protected with dispatcher's signals, and that more of these were contemplated. Arthur W. Brady, president of the Indiana Union Traction Co., said that his road has 111 miles equipped with this form of signal, and that its use would be extended at the order of the Commission. A. A. Shane, general manager of the Indianapolis, Columbus & Southern Traction Co., said that much more time than the Commission had decided to allow should be given for investigation and study of the various systems available. He said that his road had contracted for the installation of one block of signals in order to test its efficiency, and that, through the committee on signaling, of which he was chairman, this and other roads were investigating the subject, and had already found that numerous improvements on the dispatcher's signal were almost ready to be put into practice.

C. N. Wilcoxson, general manager of the Chicago, Lake Shore & South Bend, thought that such a system as would be adequate for his road on account of single-phase operation. He thought that dispatcher's signals did not accomplish what the Commission wanted, as they were not block signals. Governor Marshall said in concluding the meeting, that he thought the railways and the Commission would face the issues in such a way that the needed improvements would be made without the necessity for legislation to bring them about.

At a subsequent meeting to consider the same recommendations, held on Dec. 23, at Indianapolis, special attention was called to the recommendation regarding block signals on lines where the density of traffic requires their installation.

At a conference on Jan. 6, 1911, the committee appointed to make a report on block signals, stated that it had not had sufficient time to make a complete investigation of the different kinds of block signals in use, but that a final report would be presented on Jan. 24, 1911. The committee consists of Arthur W. Brady, C. N. Wilcoxson, Robert I. Todd, vice-president of the Terre Haute, Indianapolis & Eastern, and E. D. Emmons, general manager of the Ft. Wayne & Wabash Valley. M. H. Hovey, who has been identified with the railroad commissions of Indiana and Wisconsin as safety service expert, has been in conference with this committee.

With the Manufacturers

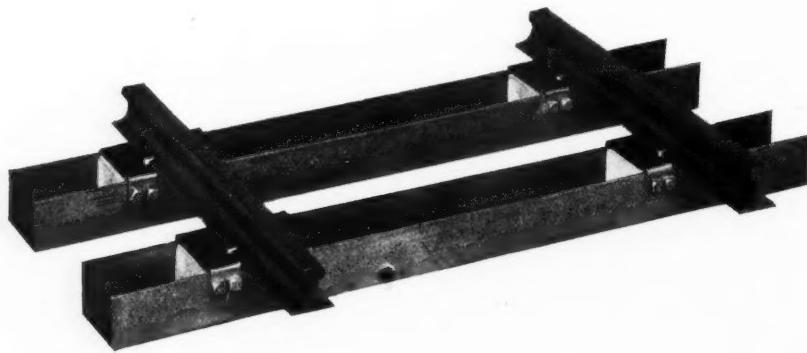
The McCloy Steel Tie.

The patentee of this tie, Wm. McCloy, is a civil engineer, member of Western Society of Engineers, Chicago, Ill., served many years with the Illinois Central and has had more than twenty-five years' experience in railroad construction and maintenance. After much experimenting, he has devised and perfected a tie which he feels satisfied will solve the tie problem, combining as it does, strength, durability, simplicity, together with economy. We quote from the prospectus of the McCloy Steel Cross Tie Co., Chicago, Ill.:

"The tie is metal, preferably bent up from a single flat rolled sheet of steel, to form a bottom portion, and two parallel upturned side flanges. The rails, instead of resting upon the tie, have their bearings upon wooden blocks, which are adapted to fit between the upturned flanges or sides and about the height of the latter, and upon each block rests a tie plate, which is narrower than the distance between the upturned flanges, so that it cannot possibly rest upon or

six or eight wood ties, and the cost but little more; and when once in the track and thoroughly tamped and put in surface and alignment, it will practically remain so. Annual tie renewals are dispensed with and the labor thus employed reduced correspondingly; the track will hold gauge better, insuring a safer and better track; the wear upon the rails will be uniform, and there will be no more jacking up track as is the case with the wood tie, especially as is done during annual tie renewals, when the track is jacked up all along the line of the road. Therefore in consideration of all these things we feel justified in saying that a saving of at least 30 and possibly 50 per cent can be realized."

"The McCloy steel tie has been examined critically by many engineers and railroad officials, as well as men experienced in the maintenance of track, also by the scientific experts of three of the largest steel corporations in the United States and without exception all have pronounced it practical and meritorious."



come in contact with the latter, the rail resting upon such plate so that the resiliency of a wood tie is secured, very much more extended than the area of the lower face of the rail and equal to the area of the plate, in fact giving a greater rail base with the same qualities of a wood tie so much desired in any new tie.

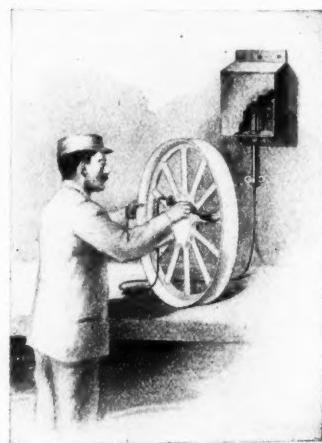
"Further it may be seen that the rail is fastened to the tie in the same manner as the present wood tie (with spikes, either square or screw), and not with iron bolts, or jaws which are sure to work loose; and all the parts are absolutely locked together by clamps on either side of the rail secured by eight bolts, keeping the spikes in place, thereby resisting all lateral strain or side thrust or the loosening of the spikes and positively prevents the spreading of the rails."

"It will be observed that when all lateral strain or side thrust is eliminated the only strain left upon the spike is an upward or vertical pull, thus insuring a greater holding power of the spike, thereby guaranteeing a safer track, as it is known that constant side or lateral thrusts force the spike from the rail (at least this is the case with the wood tie), and loosens them, thereby reducing the holding power thereof, causing the spikes to be easily forced up and out of the tie and making it possible for the rails to spread and turn over."

"It is a well known fact that the expense of maintenance of way and the wear upon rolling stock and rails is a burden felt by all railroads; and to reduce this expense, say at least 30 per cent, and keep up the track to a higher standard than is done at present, is certainly an item of interest worthy of consideration, and we feel sure this can be done by using the steel tie. Thus, it is acknowledged that the steel tie, under ordinary conditions, will last as long or longer than

An Automatically-Filled Paint Brush.

From time immemorial the method of painting has been to a dip a brush into a can of paint, clean the brush of the excess, and begin covering the surface to be painted. After a few strokes the operation had to be repeated. Until spraying apparatus was invented this was the only method of painting except by dipping. There is now on the market a new device, consisting of a brush that is automatically supplied with paint, so that the manipulator can keep constantly spreading it on. This device, which is known as the Standard Automatic brush, is illustrated herewith. The paint is held in a can or tank that can be hung up in a convenient



RAILWAY ENGINEERING

AND MAINTENANCE OF WAY.



place or strapped to a man's back, and the liquid flows to the brush through flexible tubing. The flow can be regulated by an automatic valve, so that either a heavy or thin stream can be obtained continuously through the brush. The brush is of the ordinary style and can be used in almost any place where painting can be done. The complete outfit consists of a paint tank, which is either stationary or movable, an automatic valve and six feet of flexible tubing, with the automatic adjustable brush made of aluminum. The stationary tank is used in cases where the operator is working at a bench or other place where he does not need to move about. The movable tank is designed to fit on the operator's back. The side that comes in contact with the back is concave, making it easy to carry. The apparatus is handled by the Standard Automatic Mfg. Co., 50 Church St., New York city.

The Rife Hydraulic Ram.

Rife rams are built with an automatic, air feeding device preventing water-logging and destruction by concussion, and are now being used for town water works, irrigation and railroad tank supply, as well as for farms, domestic purposes, etc. The illustration shows a plant installed for the Pennsylvania Railroad. The water used to operate the Rife rams is conveyed through a 6 inch pipe line, 1,400 feet to the intermediate reservoir, to which the drive pipes are connected,

received a single order for one hundred of these machines for a South American government contract. They claim for their rams: constant operation under two or more feet fall, water elevated 30 feet for each foot of fall used, and efficiencies ranging from 60 per cent to 90 per cent.

The Railway Appliances Association.

A supplementary list of exhibitors at the exhibition of railway appliances to be given by the Railway Appliances Association during the week of the convention of the American Railway Engineering and Maintenance of Way Association, March 20 to 24, in addition to the list published in the Railway Engineering of January, is given below.

American Railway Steel Tie Co., Altoona, Pa.
Burroughs Railway Nut Lock Co., Decatur, Ga.
Ceresit Waterproofing Co., Chicago.
Chicago Pneumatic Tool Co., Chicago.
Philip Carey Company, Cincinnati, O.
W. P. Collins & Co., Chicago.
Concrete Form & Engine Co., Detroit, Mich.
Conley Frog & Switch Co., Memphis, Tenn.
Continuous Rail & Safety Switch Co., St. Louis, Mo.
Detroit Steel Products Co., Detroit, Mich.
Engineering News, New York.
Heath & Milligan Manufacturing Co., Chicago.
C. W. Hunt Company, West New Brighton, N. Y.



as shown. The fall used is 12 feet; water used, 120 gallons per minute; pumping head, 39.4 feet; water delivered, 28 gallons per minute; efficiency developed, 77 per cent. Over thirty railroads systems are said to use Rife rams, which effect considerable saving, as they run constantly without attention or expense except for new valves every year or two, thus eliminating the cost of fuel and attendants. A plant recently installed for a town in Kansas delivers 600,000 gallons of water daily, replacing a steam plant that cost \$25 a day for operation, the rams costing less than 50 cents per day for maintenance. The Rife Engine Company recently

Iowa Gate Company, Cedar Falls, Ia.
O. N. Kelly, Salt Lake City, Utah.
Nachod Signal Co., Philadelphia, Pa.
National Roofing Co., Tonawanda, N. Y.
Standard Scale & Supply Co., Pittsburg, Pa.
Sterling Varnish Co., Pittsburg, Pa.
Strauss Bascule Bridge Co., Chicago.
Waughn Rail Support Co., St. Louis, Mo.
Weir & Craig Manufacturing Co., Chicago.
Western Electric Co., Chicago.
Whyte Railway Signal Co., Toronto, Ont.

The available space is almost entirely reserved, but a few good locations are still vacant on the balcony. A working model of the Brennan monorail system will be in daily operation on a cable over the balcony, and it is expected that this will prove one of the most novel and interesting features of the exhibit. The exhibition this year will be larger and will contain more interesting features than any held in previous years.

The Union Switch & Signal Co. has issued Bulletin 53 entitled "Track Circuit Signaling on Electrified Roads." The substance of this bulletin appeared in a paper read by G. F. Howard before the annual convention of the American Institute of Electrical Engineers in 1907. It is a good fundamental description, with illustrations, of the various types of track circuits employed on roads using electric traction and is a valuable contribution to the literature of signaling.

The General Railway Signal Co., Rochester, N. Y., has moved its New York offices from the Night and Day Bank building to the Liberty tower.

The General Railway Signal Co. has issued bulletin 115-B describing the installation of automatic block signals and automatic train stops on the lines of the Washington Water Power Co., Spokane, Wash.

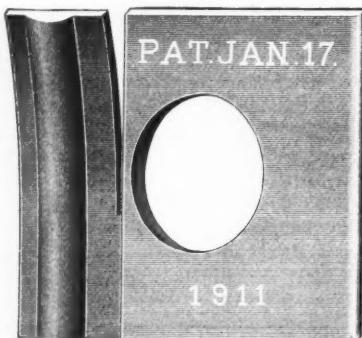
BARTLEY SELF-LOCKING RAIL FASTENER.

Milton Bartley, president of the American Nut & Bolt Fastener Company, of Pittsburgh, Pa., has just received patents granted him on January 17, 1911, for his rail fastener.



Milton Bartley.

shown in the illustration, ready for application. It has been in use on some of the large trunk lines of the country for the past six months. It is applied with the wrench and can



be removed by the wrench, but no jarring of the splice joint causes the nuts to loosen, as the oval rib is up against the side of nut, preventing the nut from turning. A portion of the fastener is always under the nut, thus leaving the oval rib standing 3/32 in. high against the side face of the nut, therefore the nut has to climb over this 3/32 in. before it can move. This fastener will be put on the market in the fall of this year, but any railway, we are advised, can have a trial lot without cost by giving the make of rail, size of bolt used and number of pounds of rail to the yard.

NOTES.

Pennsylvania Lines West in Aid of Agriculture.

The latest movement undertaken by the Pennsylvania Lines West is the distribution of a series of pocket size pamphlets bearing on the culture of wheat, oats, corn and alfalfa, and orchard planting and pruning and soil fertility. The following circular will be issued, which the officers of these lines will endeavor to place in the hands of every farmer and other interested person, together with copies of the agricultural pamphlets:

"The Pennsylvania * * * recognizing that successful farming depends, first, upon soil fertility; second, upon intelligent cultivation; third, upon adequate transportation facilities, with which to reach desired markets, has with the co-operation of the faculty of the Ohio State University, Columbus, O., prepared for distribution six pamphlets, pocket edition size, one each bearing on the following subjects: Information concerning the cultivation and production of wheat, corn, oats and alfalfa. Orchards—Information concerning planting, pruning and spraying. Soil Fertility—Information concerning its increase and maintenance.

"The Faculty of the University has supplied, in brief, fundamental facts pertaining to these subjects, which are the result of years of scientific study and experimentation, and which, if heeded, should materially add to the farmers' success and to our general welfare.

"The great educational work that is being accomplished at the various colleges and experimental stations, also the value to the farming communities of the so-called 'Educational Trains,' which have been run over the Pennsylvania Lines, is fully appreciated, and these pamphlets are intended as another effort in the same direction, for the same purpose.

"It is the desire that the pamphlets be given as wide distribution as possible, that one set (six), together with copy of this circular, be placed in the hands of all farmers and of others who may be interested, in your community, and that fact of their issuance be given the widest possible publicity."

Working in Hoosac Tunnel.

In the preparation of the Hoosac tunnel of the Boston & Maine for electric traction, the men drilling into the rock of the roof of the tunnel for the overhead supports, work inside of tents set up on the roofs of the cars of their train; and they are supplied with fresh air by compressors taking their supply from a point near the floor of the tunnel; all this to enable the men to work while engines are passing through the tunnel emitting great volumes of smoke. There are two tracks throughout the length of this tunnel (4 3/4 miles), and the work train occupies one track, while the trains continue to use the other. The work was begun at the West or North Adams end and it has now proceeded somewhat more than a mile into the tunnel on the west-bound track. The workmen protect themselves with large hats and wear goggles; and before going into the tunnel they rub their faces with grease paint. The conductor in charge of the train maintains constant communication by telephone with the train dispatcher's office at North Adams.—*Exchange.*

By an explosion of dynamite near the station of the Central of New Jersey at Communipaw (Jersey City,) N. J., on Wednesday of this week, 25 or more persons were killed and property of the railway company was damaged to the extent of \$200,000. It is roughly estimated that other property losses will amount to several hundred thousand dollars; hundreds of windows having been broken in the lower part of New York city, more than a mile from the explosion. The dynamite was being unloaded from a freight car on the end of pier No. 7 and was being carried into the hold of a lighter. This lighter and another vessel, with the crews of both, were so completely destroyed that none of the bodies of the men were found. A car of cement next to the car in which the explosion occurred was also destroyed, but a third car containing dynamite, withstood the shock so well that its contents did not blow up, though great numbers of the sticks of dynamite were scattered about the floor of the pier. About 40 freight cars were wrecked or badly damaged. Every window in the passenger station was blown out and scores of passengers on two ferry boats lying at the slips were injured by flying splinters and glass. The force of the explosion was felt 40 miles away, north, south and east. A man in a tugboat, which was nearly a mile away from the scene of the explosion, was blown out of the pilot house into the water and fatally injured. Many of the tallest buildings in the lower part of Manhattan were jarred, and in some cases, according to the stories of the occupants, they "rocked," and walls were cracked in some of them. It is conjectured that the explosion of the dynamite was caused by the explosion of a boiler of the lighter. It is said that the explosives were to be delivered for use at places in Manhattan.

Collision at Batavia, N. Y.

In a rear collision of westbound passenger trains on the New York Central, at Batavia, N. Y., about 5:30 on the morning of Jan. 13, six passengers were killed and ten or more were injured. Train No. 23, running at 30 or 40 miles an hour, crashed into the rear of train No. 49, which was standing at the station; and the rear car of No. 49, a sleeping car, was completely wrecked, the engine going through this car and a short distance into the one next ahead of it. The roof of the sleeper was thrown over on the roof of a shed at the side of the track. The wreck took fire and some of the victims were severely burned; others were scalded by steam escaping from the boiler of the wrecked locomotive. The engineman and fireman of No. 23 jumped off and escaped with slight injuries. An officer of the road said that train No. 23 had run past a distant and a home signal set against it. The engineman had been in the service of the road 40 years, and had been an engineman for the last 22 years, with a perfect record. Rain was falling at the time, and was freezing; but it does not appear that there was any fog.

In a collision near Hawes Junction on the Midland Railway, 260 miles north of London, on the morning of Dec. 24, two cars of a passenger train were wrecked and, with five others, were completely destroyed by fire. Nine or more passengers were killed, most of the bodies being burned so as to be unrecognizable. The train was the northbound Scotch express. It was drawn by two engines and ran into two engines (without train) which were moving in the same direction as itself. It appears that these two engines had been standing on the main line and had been forgotten by the signal man who, within a short time before the accident, had had to deal with seven engines waiting to be turned. The two engines of the express were only partly overturned and, from a photograph of the wreck taken after the fire was extinguished, it would appear that the first two

passenger cars were crushed against the tender of the second engine as against an immovable wall. If the circumstances are correctly reported, the obvious comment of American signal engineers on this collision will be that the crying need at Hawes Junction is an installation of track-circuit route-locking.

Dinner to J. T. Harahan.

A dinner was given to J. T. Harahan at the Blackstone Hotel in Chicago on Jan. 13 by a large number of his friends, who are prominent in the railway business. In the course of an address Mr. Harahan denounced the men who as officers of the Illinois Central had betrayed his confidence in them during the last years of his administration. He said it was his deepest regret that anything should have occurred during his administration to warrant criticism of the management of the Illinois Central, and added: "While betrayal of any position of honor and responsibility is much to be deplored, the particular feature of this whole matter which has caused me pain is the treachery to me of men whom I have trained and educated, some of them for more than 30 years, and whom I have caused to be placed in the position they occupy."

"I feel, however, that no man could have anticipated the irregularities which existed and the schemes that were employed to put them into effect, or could have discovered them any quicker than they were. Strong influences were brought to bear to cause us to discontinue the investigation, but these were of no avail and no stone was left unturned to punish the guilty persons."

Regarding government regulation Mr. Harahan said:

"I appeal at this time for some consideration to the railroads. In the last few months there has been indications of a more tolerant attitude on the part of the public. I believe that the fair-minded are appreciating the difference between the substance and the shadow, though they have heard much adverse to railway interests. I have much faith that the American public will solve this matter in a way right and proper, but unless this solution shall be found in such a way as to result in increasing the revenues of the roads I cannot at this time foresee the means to provide the additional facilities which are needed to handle properly and expeditiously the ever increasing traffic of the country."

Charles H. Markham, Mr. Harahan's successor, said that Mr. Harahan's retirement was a loss to the railway world. Other speakers were George R. Peck, Charles U. Burch, George W. Parker, E. F. Trabue, W. L. Park and Blewett Lee.

Impervious Coating for Concrete.

In a recent paper read by Leonard Wason, member of the Society of Arts, before the National Association of Cement Users, he says that the dust produced by concrete floors is no more than is produced by wooden floors, but in the latter case, it finds a hiding place between the cracks of the boards. He recommends two coats of boiled linseed oil carefully applied and thoroughly hardened. Another suggestion to do away with dust of concrete floors is to cover the surface of the concrete with water glass (sodium silicate). The surface of the concrete should be kept damp after the placing of the concrete and should then be washed and allowed to dry thoroughly. Water glass should be mixed with four to six parts of water according to the surface to be treated. The denser the surface the weaker should be the solution. Apply with a brush after four hours, and within twenty-four hours wash off the surface with clear water. After drying apply another coat of water glass solution, repeating the process above until three or four coats have been applied. This treatment is also recommended for tanks and vats, and is said to make them impervious, odorless and sanitary.

February, 1911.

Wood Preserver's Association.

At the annual convention of the Wood Preservers' Association, in Chicago, the following officers were elected for the year 1911: President, John T. Logan, National Lumber & Creosoting Co., Texarkana, Ark.; first vice-president, Andrew Gibson; superintendent of timber treating, Northern Pacific Ry., Paradise, Mont.; second vice-president, R. J. Calder, superintendent and treasurer, International Creosoting & Construction Co., Galveston, Tex.; third vice-president, D. Burkhalter, superintendent of creosoting plant, Buffalo, Rochester & Pittsburg Ry., Bradford, Pa.; secretary and treasurer, F. J. Angier, timber treating engineer, the Kettle River Co., Chicago. The officers, as above named, constitute the executive committee.

The following is from a circular issued from the president's office, Rock Island Lines:

Effective March 1, 1911, a Personal Record Bureau will be established in conjunction with the Pension Bureau. The principal purposes of the bureau are to assist employing officers in obtaining records of persons for service with this company.

To keep a record of the character and length of service of those now in the employ of, or hereafter employed by, the company.

To investigate the record of applicants for employment with foreign lines and system offices, and to report the information thereby obtained to the employing officer.

To concentrate the present record of such employees as are specified in the rules and regulations, regardless of the number of times or at what points the individual has been in the service of the company.

The co-operation of employing officers and the heads of departments with the Personal Record Bureau will enable the latter department to insure the most satisfactory results.

W. B. Ross is appointed secretary of the Personal Record Bureau, in addition to his duties as secretary of the Pension Bureau.

The State Board of Railroad Commissioners of Kansas has granted authority to the Southwestern Kansas & Colorado to issue \$1,000,000 in stocks and bonds. The certificate has been granted. The company proposes to build a line west from Anthony running through Harper, Barber, Comanche, Kiowa, Clark, Ford, Meade, Gray, Seward, Haskell, Stevens, Grant, Morton and Stanton counties to the coal fields in Colorado. The headquarters of the company are at Coldwater and the application for permission to issue the stocks and bonds was filed by Elijah J. Hurd of that city.

Anti-Pass Bill in Illinois.

Two bills to prohibit issuing of railroad passes within the state of Illinois, were introduced in the senate of the Illinois legislature, Wednesday, Jan. 25, and on the same day one similar measure was presented to the house. Senator Hurburgh, of Galesburg, introduced a bill which has been agreed upon by the senate organization working through the state's legal advisers, and which is believed to cover all points of the free pass situation. It does not prohibit exchanging transportation for advertising. Senator Bailey's bill is similar in many respects to the Hurburgh bill, but it carries into its provisions practically all varieties of public service corporations. In the house Representative Flagg offered a

measure, intended, as he explained, to complement an anti-pass law, and carrying a provision concerning legislative salaries, to which is appended a section which authorizes the members to draw mileage from the treasury at the rate of two cents a mile each mile actually traveled in going to and from Springfield during the legislative sessions.

Mayor Gaynor, of New York city, is having prepared a bill, to be presented to the legislature, to provide for the construction of a freight railway along the west side of Manhattan Island, in accordance with the plans which have been proposed by Dock Commissioner Tomkins.

The text of the bill for the amendment of the Illinois railway commission act, which has the backing of Governor Deneen, has been made public. The bill gives the railway commission jurisdiction over all common carriers and the term "common carrier" is made to include railways, express companies, steamship lines, private car lines, sleeping car companies, fast freight lines and all other persons or corporations engaged in operating any agency for public use in the conveyance of persons or property. The term "transportation" is made to include not only the actual act of transportation, but all services performed in connection with it, such as refrigerators, storage, etc. The commission is given substantially the same jurisdiction over state business that the Interstate Commerce Commission has over interstate business, and, in addition, the regulation of security issues is provided for by the following provision:

"Sec. 14. No increase in the capital stock or the bonded indebtedness or any fixed indebtedness by any common carrier shall be created without application first being made to said commission. Upon said application being made the commission may employ competent experts to investigate the character, cost and valuation of the property of such common carrier and its present indebtedness and liabilities and the necessity for the proposed increase of capital stock or bonded indebtedness or other liability, and after such investigation shall determine whether or not such stock shall be issued or such bonded debt or other liability be created."

By a strict party vote of 7 to 5 the House committee on claims voted on Jan. 16 to recommend the payment of \$773,000 to the Southern Pacific railroad for its work in repairing the break in the Colorado river three years ago when the Imperial valley in California was overflowed. The bill approved by the House committee has already passed the Senate. The Southern Pacific put in a claim of \$1,600,000 as the cost of the work, but this was reduced. A bill requiring that the railroads of the country adopt a uniform system of signals was introduced in the Senate on the same day by Senator Jones, of Washington.

It is reported that preliminary work is to be immediately begun on the construction of the Libby-Kalispell cutoff of the Great Northern, up Sun river from Great Falls, Mont., about 100 miles. This will put Kalispell back on the main line of the Great Northern, and shorten the distance between the two places named about 30 miles, while at the same time tapping one of the richest parts of Montana.

The National Railways of Mexico has just taken steps towards greatly increasing the water supply for its system at various points along the different lines. J. L. Thompson has been awarded the contract for boring many wells for the company and will begin work at Metapac, state of Vera Cruz.

